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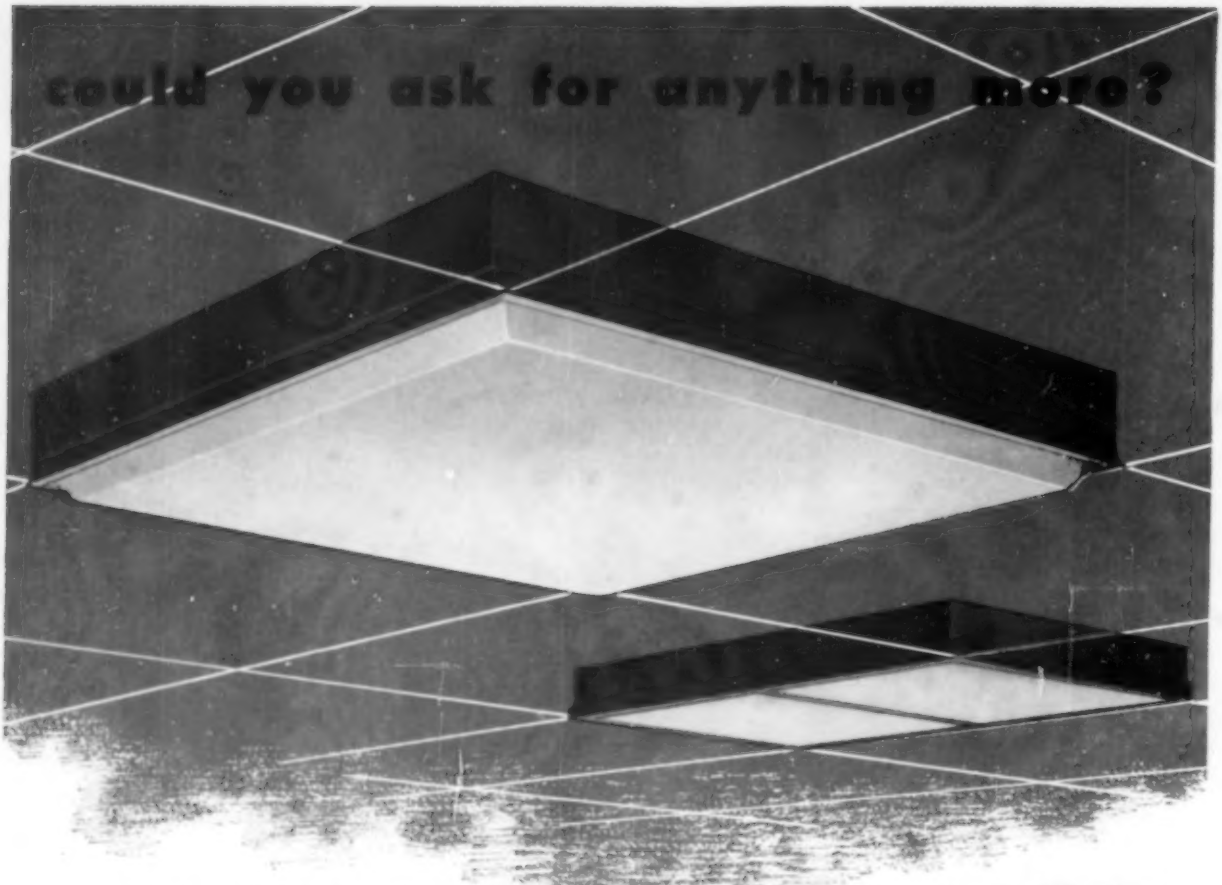
# ILLUMINATING ENGINEERING

AUGUST 1960

*Journal of the*
ILLUMINATING ENGINEERING SOCIETY

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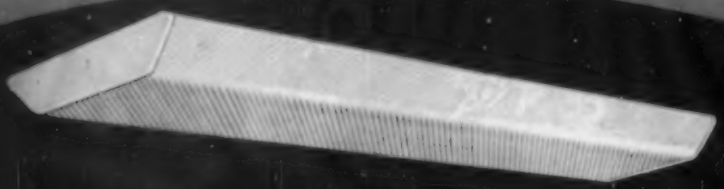

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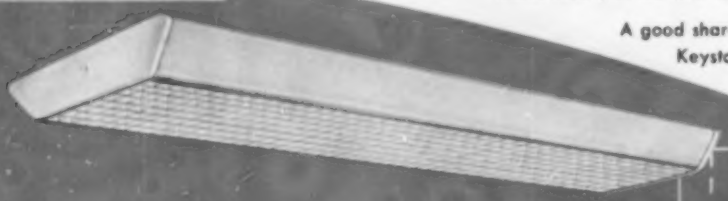

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THE JOURNAL OF THE ILLUMINATING ENGINEERING SOCIETY

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## Contents

415 Esthetics in Lighting, An Editorial

416 Esthetic and Psychological Effects of Lighting—A Panel in Print

416 New Thoughts on Lighting Design—George W. Clark

421 Lighting Design—Whose Job?—Henry J. Wald

425 Bland Environments—Henry L. Logan

429 The Importance of Esthetics in Lighting—Abe H. Feder

431 White Light—What Is It?—Rollo Gillespie Williams

435 An Interview with Gyorgy Kepes

436 Spotlight on Science—Esthetic Installations in Work Areas

442 Accent on Art—Esthetic Installations in Glamour Areas

450 Recommended Light Characteristics of Acrylics Used in Illumination

453 IES Lighting Data Sheet—Series XXV
Lighting an Indoor Swimming Pool (20-36)

7A Lighting News
Scheduled Events, 21A; About People, 24A; Books and Pamphlets, 29A; New Members, 30A

42A Index to Advertisers.

Sustaining Members—Refer to March 1960 Illuminating Engineering

Committee Personnel—Refer to April 1960 Illuminating Engineering

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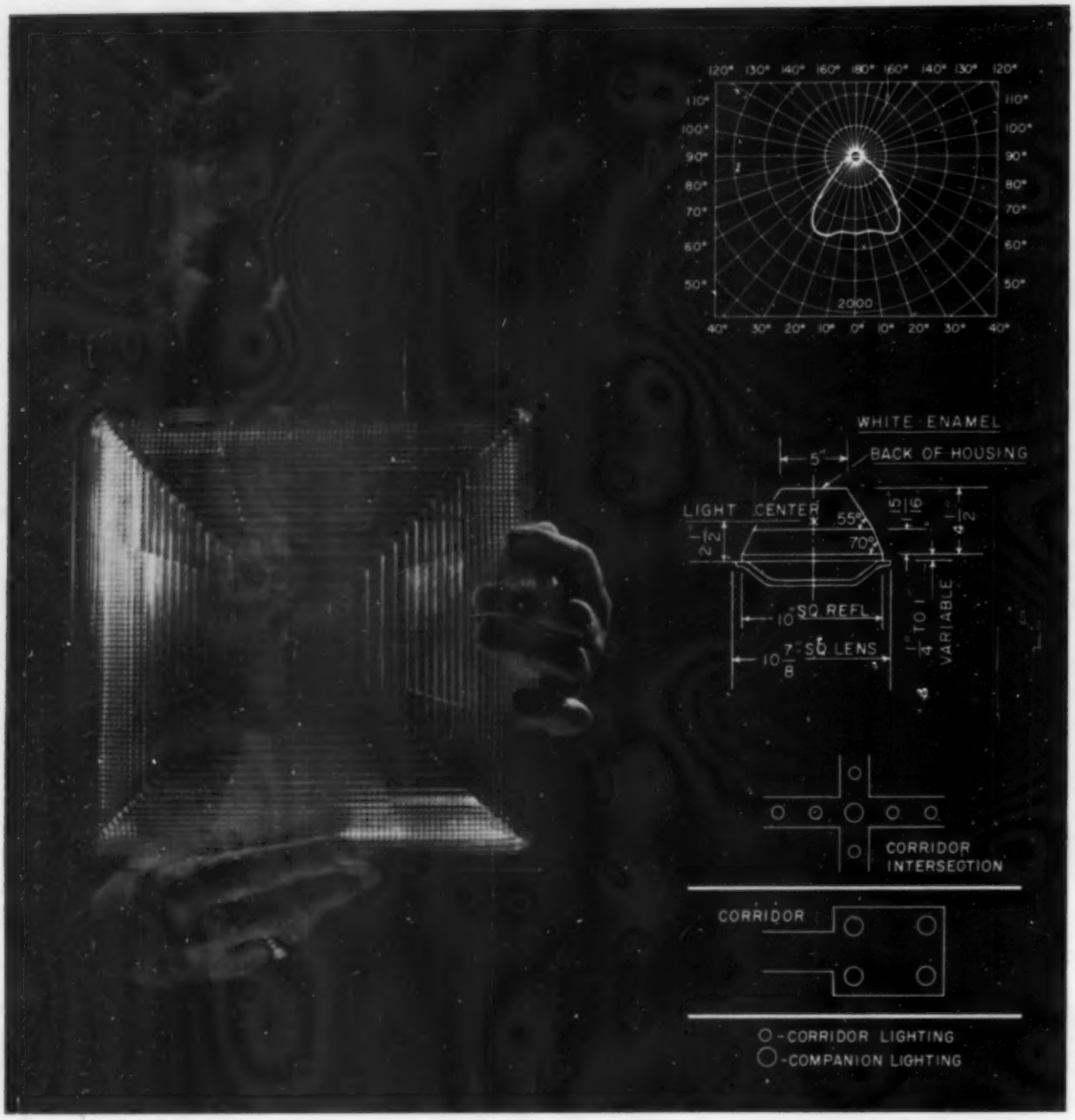


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# ESTHETICS IN LIGHTING

ARCHITECTS, through the pages of their own trade press, frequently discourse on Esthetics in Lighting. Engineers seldom do. This is not to say, however, that an appreciation of this aspect of lighting is exclusive with any one group. The language of esthetics — or psychological effects for that matter — does not come readily to the pen, for engineers. But over the years tasteful, esthetic lighting techniques have developed from many directions, including the engineers'.

IN THE opinion of some of the panelists, however, whose comments begin on page 416, there is room for more attention to esthetics as a principle of lighting. This Panel in Print presents only five of the numerous men, including many engineers, who have made a similar plea. Dozens of others are qualified to comment; these, in effect, speak for their fellows.

SOME OF THE things that light does to an interior, they all remind us, are things you can't measure. These things affect how we react, they note, and they bid for deeper understanding of what is involved in "lighting design."

MOST ARTISTS and/or architects will agree that the substance of a lighted interior may be its correct luminous characteristics. In this they are in agreement with the engineers. The burden of their plea (and that of many engineers also) is that this substance may in no way be impaired by incorporating into this design, esthetic and psychological aspects of lighting *as well.*

MANY INSTALLATIONS have successfully done this. For a few examples see pages 436 to 449. These lighted interiors have applied both the principles of good lighting, including current footcandle levels, and pleasing design as well. They represent only a sampling. Many more could be cited, both in this country and from European practice.

SINCE THE point is made so often, there must be *some* feeling, true or not, that the artist must be constantly sold on the practical aspects of lighting—and the engineer convinced that art has its importance. Actually, though these two aspects may not yet be wed, they have been "going together" for quite a while. Since 1906, the stated aim of IES has been ". . . devoted to the *art* and *science* of illumination, and the dissemination of knowledge related thereto."

# New Thoughts on Lighting Design

A FEW YEARS ago my colleague Richard E. Harz and I presented an IES Conference paper[1] which made the point that the next big advance in illuminating engineering might well stem from an understanding of the psychological and "pleasantness" aspects of lighting. This paper (available in multilith) outlined the years of work on the "footcandles and footlamberts" phase of illuminating engineering—the scores of papers, the notable advances in adequate levels and improved brightness control. After footcandles and footlamberts, we asked, what should be next?

Three more years of experience since then convinces me, more than ever, that what should be next is acceptance of other aspects of accurate and comfortable seeing, as part of the engineered design. We must continue, of course, to measure our designs against our known principles of adequate illumination and adequately controlled illumination. But I submit that the psychological impact of a lighting installation is inescapable. It is not a thing which is superimposed upon the other design factors but conversely it is not something which we can omit. Whether we intend it or not, each installation has some psychological effect. This being so, it seems only logical that we should attempt to design into our lighting installations a psychological impact which is favorable. Granted that our knowledge in this area is limited and that the subject is undoubtedly an involved one, its complexity will be no excuse for ignoring it. The fact of the matter is, we may quite possibly be nullifying to some extent the benefits of higher illumination levels and better brightness control by the adverse psychological effect of some installations.

### Work Areas

More experienced men than I have expounded the benefits of lighting for special visual effects in stage and theatre, and for varying moods and esthetic effect in homes, restaurants, stores. My proposition deals with lighting for working areas—factories, offices, drafting rooms, classrooms.

For these areas the lighting design *must* include consideration of illumination, brightness distribution, specular reflection, shadows and economics. These are six of the eight factors listed by Moon and Spencer[2] as a check list to solve nearly any lighting problem. The other two factors of their eight-point list are Psychological Effect and Esthetic Effect. For a really good lighting design we should consider these factors also. In fact, we *must* consider them since they are inescapable.

For working areas especially, we have given rather too little consideration to these two points in the lighting jobs we plan. We have been thoroughly "sold" for a long time on the importance of the first six, in varying degrees at any rate. Illumination and brightness distribution seem to be receiving adequate consideration (from the lighting designer, that is). Specular reflection sometimes becomes a casualty to compromise, but its more positive aspect, "sparkle," is quite generally applied—especially in stores. Uniformity is well accepted, and usually achieved. So are shadow effects, or the absence of them. And, of course, economics is high on the list of factors checked in almost every lighting installation. These six of the Eight Factors of Lighting Design have had our serious consideration, whether from desire or necessity. And having checked these points, we have been content that our lighting installations have been acceptably good.

For the average engineer the very words "psychological effect" and "esthetic effect" have an egghead sound. They don't seem to mean anything. As an engineer myself, I'd like to make the point that in a lighting design they can mean a great deal. They can make all the difference, to the people working under the lighting installation. I don't mean only a difference in the pleasure they feel (though certainly pleasantness just in itself is worth planning), but even in work output, alertness, and many other psychological benefits.

In point of fact, it is difficult to separate "esthetic effect" from "psychological effect." A successful esthetic effect in lighting has, *ipso facto,* many psychological advantages. Conversely, planning for psychological benefits can scarcely avoid esthetic design. Seeing is a *mental* process.

### Psychological Effects

For lighting, perhaps the most effective means to good psychological (and its twin, esthetic) effects, are these: COLOR—ARRANGEMENT—CHANGE.

**A main premise of this author is that some psychological impact is inherent in every lighting installation; that this is inescapable, that this is so whether or not it is intended. Without some effort to guide this psychological effect into a favorable one for people living and seeing within the interior, we may nullify the benefit of better lighting—higher levels and improved brightness control. Several interesting suggestions are made here for achieving this favorable lighting environment.**

By GEORGE W. CLARK

*Color*

The very least of us is familiar with the use of color. This is a popular subject anyway, and many of its psychological aspects have filtered into lighting practice. We have used the effects of the warm and cool attributes of color, receding and advancing colors, and other effects. We are even aware of some of its deeper effects, such as the creation of moods or emotions, calmness or depression, etc. However, except for stage and display lighting, these have been used to a very limited extent.

For more stimulating installations, to say nothing of pleasantness in lighting, we could give much more attention to our use of color in lighting. Color in our baffles; color in our luminous panels; color in luminaires; color and pattern in lighting arrangements, and, of course, color for interior surfaces. As a matter of fact, there's no law against using color in the ceiling, although you might think so, from most designs.

*Arrangement*

Arrangement, to use the term loosely, has infinite possibilities for advantageous psychological effect. We are familiar with many of them. Brightness patterns created by luminaire arrangements have been used to influence traffic flow. The attraction value of higher lighting levels has been used to draw patrons toward the rear of stores. Luminaire arrangements have been selected to compete with dimensional problems such as those of a long narrow store. Luminous and illuminated ceilings are recognized as being psychologically "higher" than dark, opaque ceilings. Brightness patterns created by room surfaces and lighting equipment may create a gloomy, or a cheerful, atmosphere.

Here again, however, bonuses in good psychological effects are possible simply through arrangement and pattern. Luminaires do not always have to be in neat engineered rows. With no loss in illumination, they can be arranged in pleasing patterns. Wall washes, luminous panels, patterns of light—any number of other techniques are feasible economically. My bid is for still more attention to this feature; making it an automatic check point.

Both color and arrangement are, of course, closely related to the third suggestion — Change.

*Change*

The effect of change is well worth looking into for lighting techniques. Business management has almost completely accepted the proposition that rest periods are worthwhile. The rise in interest and energy levels they generally provide have justified the practice almost universally. The extensive Hawthorne tests[3] indicated the benefits to be derived from this and other changes for employee morale and productivity.

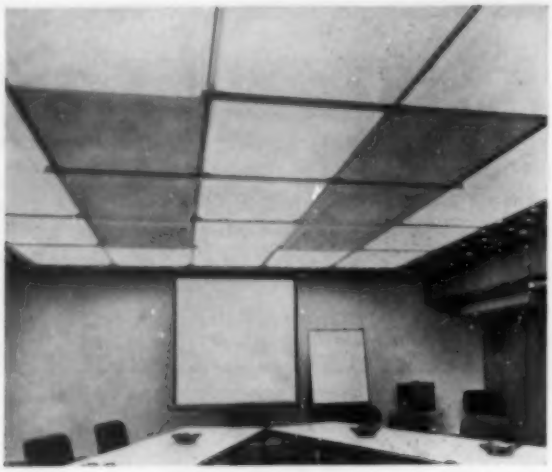
While there have been several references in the literature[4, 5, 6] to the potential advantage of variable lighting systems, there has been little or no attempt to apply it to lighting for offices and other areas where close visual tasks are performed.

At the 1953 National Technical Conference in New York the Society was privileged to hear a paper by H. C. Weston on "Visual Fatigue."[4] While the entire paper was an excellent contribution to our knowledge of this subject, perhaps its most challenging aspect for the illuminating engineer was that section which had to do with *visual boredom*. Have we done enough, this paper asks, when our lighting design provides adequate illumination, freedom from distracting and disability glare, and even an esthetically acceptable appearance? Even an artistically and tastefully designed interior is static, and over a prolonged period of time one may tire of it. A woman's new dress or hat, a new car, a fresh coat of paint, all seem to have an influence on people well beyond that which can be attributed to appearance alone. A new management, for example, changed the office desk

AUTHOR: Sylvania Fixture Division, Wheeling, West Virginia.

## Change in Appearance of Conference Room Through

Six pink panels in center of room.



Rearrangement of pink panels.

arrangement simply to emphasize that there was to be a fresh start—a new opportunity.

Many psychological benefits of change can be obtained from our lighting installations. It is possible to make office lighting, for example, "suitably variable though constantly adequate."[1] Further, not only is it possible, but there is substantial evidence that this should be part of today's lighting practice if we as illuminating engineers are to realize our aim of contributing through lighting to the comfort and well being of our fellow men.

What tools are presently available to make this possible? The remainder of this paper presents some of the practical approaches available *today* which will introduce *change* into lighting design.

### Change Factors

Three areas of change are readily available:

1. Spectral quality of illumination
2. Appearance of lighting system
3. Intensity of illumination.

These are not new to lighting. They are frequently used to create atmosphere, mood, highlight, and other special effects in the merchandising and dramatic field. But why not apply these factors to offices, classrooms, drafting rooms, light industrial areas, conference rooms — or in fact any "working area"? Management is interested in making people happier, more comfortable, etc.

Assuming, of course, that the lighting system meets recommended practice, and is esthetically acceptable, here are a few practical methods of introducing psychologically beneficial changes:

(a) Variation in spectral quality—by integrating two or more fluorescent colors; using two or more types of sources; addition of color filters.

(b) Varying illumination levels by rheostat for incandescent lamps and variable impedance transformers for rapid-start fluorescent lamps. Dimmer ballasts and control equipment are practical and economical factors in present electrical systems.

(c) Varying the appearance of the system by:

- Rearranging the luminaire design or shape.
- Altering the brightness (luminous) pattern.
- Changing color, form and texture patterns of luminous or translighted ceilings.

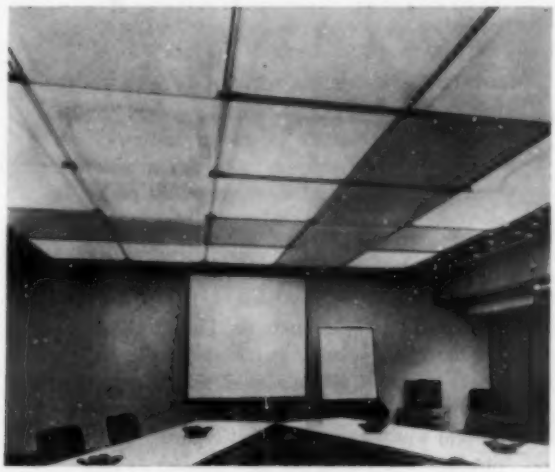
Even these simple techniques will make a monotonous, static system interesting and dynamic.

Changes introduced into a lighting system may also be paced as to *time*. That is, they may be slow transitions, changes which once made remain as is, or changes brought about by normal equipment modifications. Then again, they may be semi-static changes of a slightly faster "pace." Some of these would be the introduction of color, form and texture; acoustic baffles of different physical dimensions and color; translucent plastic panels in various shapes, sizes and colors; louvers in various sizes and colors; layouts of the luminous pattern which may change with the office layout.

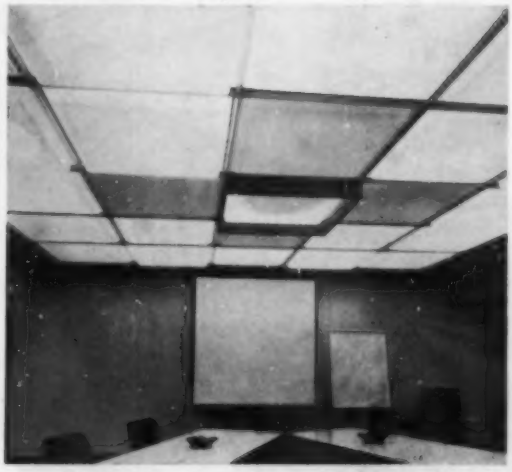
Probably the most stimulating changes, however, are those which may be made more frequently, some of them even hour to hour. An interesting experiment conducted by Mr. Harz and myself demonstrated some rather dramatic effects of daily and/or hourly change in the lighting system.

In a conference room used frequently as a training and discussion center for lighting men, we in-

## Simple Rearrangement of Modular Panels and Baffles



Yellow panels across front, pink down length of room.



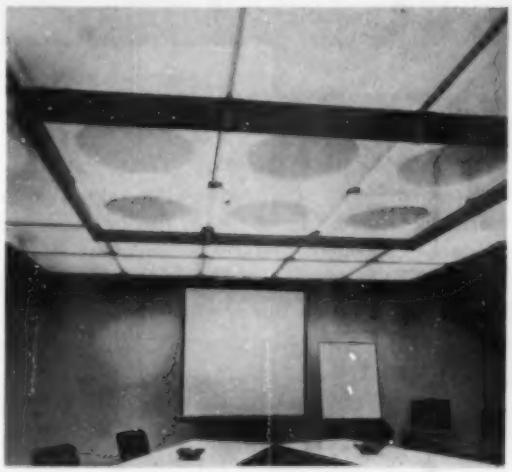
Two different panel shapes; baffles introduced.

stalled a modular lighting system so designed that numerous changes could be effected in levels, colors, brightness patterns, form, texture, etc. Each morning before the session started, the arrangement of panels and/or baffles was changed. These daily changes were not necessarily drastic although a comparison of the first day with the last showed that the pattern changed considerably.

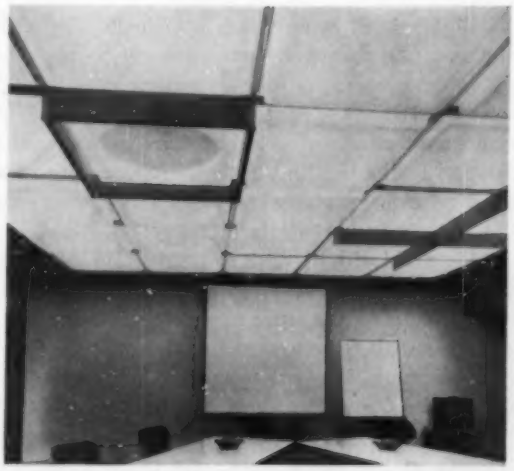
The lighting layout consisted of 13 rows of single-lamp strip luminaires using 40-watt rs lamps on approximately 18-inch centers. The luminaires were wired so that alternate rows were on separate circuits. Seven rows were equipped with dimmer ballasts and six rows with standard ballasts. Cool white lamps were installed in the six rows and warm white lamps in the seven rows. Now we were able to vary two of our change factors: spectral quality and intensity of the illumination.

As the output of warm white lamps is increased, it produces a new atmosphere—like the introduction of sunlight on an overcast day. We know the spectral quality of "white" fluorescent lamps does not affect the physiological factors of seeing. However, the reflecting characteristics of colors materially change when subjected to different types of "white" fluorescent lamps. Therefore, the "apparent" colors of the colors we actually see greatly affect the psychological factors of vision.

With the layout described, we were able to obtain a gradual change in the spectral quality of the illuminant only with an increase in resultant illumination intensity. If it is more desirable to change the spectral quality without increasing the illumination level, then all the lighting fixtures would



Panels and baffles in symmetrical arrangement.



Asymmetric arrangement of panels and baffles.

Basic esthetic elements of Variety with Unity are demonstrated in this lighting design for the New England Mutual offices in Boston. Each section of this T-shaped room has a different function. For each of these areas, the design is different—both as to color of plastic panels and baffles, and as to footcandle levels. Yet each has unity, one with the other. Separate functions have been indicated, almost entirely through the lighting pattern, but at the same time the whole is tied together in a logical manner. Variety is also achieved through the use of color and form. In a planned and pleasing pattern, white and pink plastic panels are used with blue and yellow acoustic panels.

incorporate dimmer ballasts. Thus, the dimmer controls could be synchronized to vary the color quality completely from cool white to warm white and yet maintain a relatively constant illumination level. Another approach would be to add pink fluorescent lamps to the original layout instead of warm white. Naturally, fewer would be required to get the equivalent change in color.

For an hourly change in lighting effect in the conference room, another device was rigged to change the luminous and brightness pattern on the translighted ceiling system at a still faster pace. From the lighting fixtures were supported two devices which controlled the rotation of 300-watt R40 floodlights with color filters attached. The amber and red patterns were synchronized to provide a changing pattern on the luminous plastic. The colors were subtle (not distracting) and the psychological effect of a changing pattern added interest to the lighting design. The cycling of the timing device was one revolution per hour; thus the pattern repeated itself every 60 minutes. A refinement could be designed into this homemade device (*i.e.* cams, eccentrics) to provide a continuously changing pattern; *i.e.*, not repetitious.

As the men congregated in this conference room each morning, they all seemed to notice the daily change in the appearance of the room. Psychologically they were stimulated, pepped up to participate in the day's work. As the day wore on, the men reached various stages of inattentiveness due to mental and visual fatigue. At this point one of the experimenters would vary the illumination level, being careful not to make the rate of change consciously apparent to the occupants. It was intersting to notice the unmistakable change in the men's alertness. Although they were completely unaware consciously of any change whatever, they subconsciously responded to the change, removing their drooping heads from their hands, changing their positions from a slouch to one of alert attention, and otherwise returning to their morning freshness. Group discussions became more active.

Periodic adjustments, both higher and lower, in the illumination level, we were convinced, will psychologically provide a more pleasant and efficient visual environment. Likewise, I believe lighting systems which incorporate other factors of Psychological Effect and Esthetic Effect, as well as the other six factors of a good lighting job, may well be the next big step in lighting.

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# Lighting Design—Whose Job?

**Whose job is lighting design? It has to be part of the whole design, this author feels, and therefore a concern of each group connected with the building. Illumination must be understood within the total complex of environmental control, he says, and those who devote their efforts to understanding the complex can best serve design.**

By HENRY J. WALD

In lighting design practice, several different individuals or groups are involved, or should be. Where one man's job leaves off and another's begins, however, is hard to define. This may be the crux of the difficulty between the architects and the engineers in establishing the proper emphasis in a lighting design.

Offhand, it would seem ideal if each could say precisely, "this particular phase is *my* job and nobody else's"—and so devote all his efforts to a specific task. It would seem ideal if the architect could specify his own stopping point and the engineer's starting point precisely; if the engineer could similarly define the relationship between himself and the equipment manufacturer. Either of these definitions of function rarely occurs. Perhaps for the state of the art they never should. Improvement in lighting design will require closer teamwork, not less. Again for the sake of the art, closer coordination and understanding are worth striving for.

Job specialization is a desirable element of modern administrative organization. However, whether any degree of specialization contributes to successful creative expression in lighting design is moot. In many cases the best solutions to problems in lighting design (problems whose complexity has been compounded many times over in recent years by the demands of dynamic changes in architectural design) are those in which the problem solvers have had much broader understanding than would be expected from narrow disciplines or technologies. Here the narrowing down of function by job classification doesn't fit the needs of design too well.

Author: Wald & Zigas, Consulting Engineers, New York, N. Y.

Why is this worthy of mention? Why does such a situation pose a problem at all? It appears to me to be a serious problem because the forces shaping the design of contemporary buildings place greater stress than ever before on the capabilities of the illuminating engineering group, in particular. They do, of course, recognize other contributors to the building, but "lighting people" have a particular importance at present. Those involved in this group range over a wide area occupationally, as indicated by the diverse membership of the IES itself—architects, interior designers, electrical engineers, equipment manufacturers—all of whom are required to make knowledgeable contributions to the final solution of the lighting problem.

The crux of the matter lies in the fact that in the process of making this contribution the parts of the group, individuals or subgroups, must be capable of understanding what the others are contributing and must be able to communicate intelligently to others within the group. If this seems to be a self-evident requirement, the frequency with which it is met in practice does not bear witness to its recognition. Because each bears a distinct title he tends to confine his thinking to a limited portion of the problem solving, to the exclusion of what

apparently concerns the others alone. How this happens, where the communication fails, can be seen in the educational background of the group and in the failure to develop meaningful terminology for transfer of ideas.

Architects in the United States in general spend a minimal amount of time on formal study of illumination. Usually the study is crammed into two, three or four short lectures in a survey course dealing with all of the aspects of environmental control; air conditioning, water supply, waste disposal, acoustics and vertical transportation. The twentieth-century da Vinci professionally competent to teach all of these aspects with a high degree of skill, considering the demands and dynamics of modern architecture, is a difficult man to find. In addition, he is too sorely beset to do justice to the work on illumination design within the few hours allotted in the course syllabus.

Sometimes an alternate solution is to conduct the course of study with the instruction in illumination by a guest authority. Oftentimes this does not provide much either, because the keystone of interrelating all of the aspects of environment with the total of the building never is set into place. The student is left with the unintended impression that lighting is a separate part of the design; one that can be tacked on to his building as a "trade." This is a concept which perhaps stems from our conventional division of construction drawings and specifications according to the divisions of mechanics and craftsmen who will build the building.

Most of us would say it is axiomatic that separating the lighting from the whole is wrong. To be absolutely fair, architectural schools do recognize the concept. Alas, however, as we know from the results; from the working test of whether the lighting effect, the equipment to produce it and how it is physically installed is considered in the original concept, only lip service is apparent, because the foundation work is sketchy. We firmly believe, therefore, that more time must be dedicated to development of thought, as well as techniques of presenting thought, concerning the lights, shadows, color values, moods created, etc., so that the communication becomes meaningful and the final installation creates a space with the character visualized subjectively. Perhaps an education program similar to the following, suggested by Architect Derek Phillips in the *Journal of the Royal Institute of British Architects* (September 1956) would be helpful:

(a) The characteristics of natural and artificial light sources, their spectral qualities. Illumination levels and economics and the special characteristics of sunlight.

(b) Criteria for lighting design. There is a need here for a clear statement by the schools, both in terms of technology as the means, and the formal and functional requirements of lighting in buildings as the end.

(c) Methods of light control and optical systems. Principles of window design and design of lighting fittings (luminaires). Materials used and additive and subtractive mixture of color.

(d) Physical properties of surfaces to be lit, analysis of materials (in relation to lighting).

(e) Simple calculations for design of lighting installations, both natural and artificial, and the relationship between them.

(f) Methods of installation related to structure and methods of electrical distribution.

Harold Leeds, AIA, Chairman of the Department of Interior Design in the Art School of Pratt Institute, has recognized the vital need for integrating lighting design within the totality of other interior design, and so has introduced a full-year course in lighting, one three-hour class per week, into the basic undergraduate curriculum. I have had the privilege of teaching this course in its first year. I observed with much satisfaction how students having scant background for appreciation of what are basically mechanistic and engineering concepts tend to demand more and more theory than was anticipated. It was also gratifying to observe that the lighting designed as part of the design problems in other courses had meaning for the over-all design. It was also evident, after a first presentation of this course, that more refinements were needed in order to meet students' needs and to extend their innate capabilities for conceiving esthetic possibilities with respect to light.

Aside from the time in instruction, the big gap to be filled lies in the development of terminology to transfer the subjective ideas of the architect and designer concerning the moods they want to create, to the illuminating engineer who is concerned with physical equipment, with luminaires, lamps, wiring and controls. I stated my views on this matter in *Architectural and Engineering News* (May 1959) as follows:

"Attempts have been made in widely divergent directions to establish suitable terminology. To date, none of the efforts seems to have acquired complete acceptability on either side of the professional fence. On the one extreme, the efforts by lighting researchers Moon and Spencer to establish a new and precise series of terms have received little encouragement from established practitioners in the lighting field. Certainly, their work has

never received serious practical review by practitioners of architecture. Architects generally do not make wide use of the existing terminology involving 'footcandles,' 'footlamberts' and 'candlepower' with significant understanding. On the other hand, it remains to be seen whether terminology such as Richard Kelly's subjective descriptions of light 'play,' 'ambient luminescence,' 'focal glow,' and 'play of brilliants' will enable those practitioners who deal with mechanistic concepts to transfer esthetic ideas and architectural concepts effectively."

As a further example, the architectural criticism of the recently constructed John Hancock Building in San Francisco in *Architectural Forum* (April 1960) says about a major office space: "There is also a sense of elation in having the ceiling as high overhead." What meaning would such a statement have to the majority of IES members who might be given the task of designing an illumination system to meet such a description of an important mood as felt by the architect? A photograph of the installation indicates that the office space is lighted with recessed baffled downlights, combined with large pendant-mounted enclosing globes, both of which components considered from the viewpoint of direct and reflected glare would cause goose pimples to rise on the skin of anyone in the least familiar with the years of effort on the part of IES committees. Yet, when one considers the intricacies of design, wherein one is trying to fit the many simultaneous and conflicting criteria to the needs of human occupants, *for more than physical comfort*, how can we determine whether or not the effects of the feeling of space do not overpower the deleterious effects of glare? We cannot condone this violation of IES standards, but at the same time our ability to condemn stands on shaky ground.

Where do most illuminating engineers stand in their ability to project the subjective ideas such as elation, spaciousness, intimacy, playfulness, etc., into their design? In most cases, unless they have had the benefit of architectural training, or formal or informal introduction to esthetics, they are in limbo. From this point of view, it seems doubtful that engineers have very much strength to bridge the gap from their own position. Most illuminating engineers have been trained professionally as electrical engineers, designing illumination systems as a result of the fact that the luminaires are activated by energy at the tail end of the electrical distribution system. This is unfortunate. Furthermore, at the time of writing, the future looks bleak for attracting graduate engineers into this area of practice because of the strong shift from the so-called power option in engineering colleges toward electronics engineering, with its vast hopes for the future, as well as significantly higher pay. In engineering colleges in New York City today there is only one elective course available in illuminating engineering. The situation isn't much better elsewhere in the country.

Therefore we believe that the onus of design is shifting strongly toward architects and interior designers. These people will require other abilities than those at hand now in order to utilize more effectively the services of technicians in the lighting industry. The number of professionals capable of performing on a high level to meet the needs of the startling shapes of buildings, and the extraordinary materials and techniques which are part of their construction, is limited—with no signs of increasing. It would be well for professional schools to recognize this effect on illumination design, and to take steps to reinforce their students in the totality of design. Certainly control of the direction of lighting design by the one principal who can see all parts, is good. It should not be construed as license for utter dictatorship, but on the other hand absoluteness of direction is required.

### New Illumination Levels

Another critical question that arises is whether any conflicts are occurring between esthetic design considerations and the illumination design criteria concerned with the measurable performance of humans, *e.g.*, footcandle levels. It appears to me, from limited observations in my own professional practice, that such conflicts (and they existed even before the Blackwell research data and their subsequent adaption to IES Recommended Practices) have been accentuated to some extent by the new footcandle levels. This is especially so if one realizes that esthetics encompasses much more in design than lighting alone.

For a specific example, let me cite the situation in New York City office buildings. In New York, and I daresay in other cities also, it is common practice in leasing agreements between building owner and tenant to incorporate provisions for a stipulated quantity of light to be supplied to the tenant. That is, a given number of maintained footcandles. In spite of the extraordinary demand for good quality office space in New York City, there is nevertheless considerable competition between real estate firms for the leasing of such space. Perhaps as a result of this competition, a reasonable quantity of high quality lighting now is an accepted part of the "package" of air conditioning, high speed automatic elevators, acoustical control, flexible features regarding space layout and

communications. These are all, more often than not, offered to the prospective tenant as integral components of the building.

After several years of resistance, real estate firms setting the pace for the field had finally adopted the IES recommended level of 50 footcandles maintained as their "building standard." This was a remarkable step in itself. It meant recognition of the authoritative source represented by the IES by managements basically commercial in character and conscience. However, soon after this somewhat general acceptance, the recommended levels were revised upward for most office seeing tasks.

Did the revision confuse? It certainly did! We found that the architect's questions to the consulting engineer were, "Are these lighting levels *necessary?* Is it *mandatory* that we call for the lighting systems to produce not the 50 fc we were persuaded were adequate for the seeing task, but 100 fc or more, minimum at any time, for those same tasks? You engineers, our experts, have confused us."

Did revisions in the mechanistic design criteria for lighting affect esthetics? Here the answer is somewhat indeterminate. Very possibly yes, however, since indirect economic effects proceeding from acceptance of the higher illumination levels may affect the over-all design of the building. Specifically, if it is assumed that a nominal dollar-per-square-foot of floor space in the initial construction cost is chargeable to the illumination system that produced 50 footcandles, then the cost is almost doubled if the level is 100 footcandles. This is quite aside from the increase in initial building cost chargeable to further loads on air conditioning systems. This incremental increase represents 3 to 8 per cent of the total construction dollar, a significant increase in a highly competitive commercial field. Such costs have been discussed in greater detail by Mark Eitingon in the July 1959 issue of ILLUMINATING ENGINEERING (p. 469).

Assuming further that within a limited time framework the total construction dollar is a fixed item, then one part of the total design from which the incremental cost for lighting might conceivably come is from those materials whose prime function is the esthetic enrichment of the building. This is a choice usually repugnant to the architect. It is more likely that the architect, who has yet to be universally persuaded of the valid economic justification for the lighting, will reject the higher levels. I do think, however, that the frequency of this rejection is temporal. I think the total construction price structure may readjust itself to include what we know is a vital contribution to optimum human performance. The weight of scientific evidence is certainly incontrovertible.

In a recent address before the Massachusetts Building Congress in Boston (on June 14, 1960), Charles Luckman, AIA, president of Charles Luckman Associates, had this to say concerning the interelationship of the many influencing factors: ". . . In my view, the only concept of design that has a future is one that is comprehensive enough to bring into focus the entire process of putting up a building. That process must accommodate not only esthetic appeal, but also the needs of the client, the limits of his budget, the engineering requirements, the legal and tax aspects, and the effect of social and economic influences. . . . .

"The immediate future calls, more than ever before, for architects who understand that architecture is for people. There is less room than ever before to accommodate art for the architect's sake. Design must be approached in the totality of its aims; as a venture in creative problem-solving with recognition that, while design is important, it is only one phase among the many in the process of building."

Paraphrasing Mr. Luckman, it might be well for illuminating engineers to understand that lighting is for people, that lighting design may utilize many tools of the engineering world, but that these tools are not the end in themselves. Illumination must be understood within the total complex of environmental control. Those who devote their efforts to understanding the complex can best serve design.

***Do we pay too high a price in livableness and even in visual comfort by "by the book" luminous environment—"perfect" installations of wall-to-wall lighting, precisely-spaced luminaires? This member of the panel feels we do — and outlines his views on this aspect of lighting and his suggestions for a solution.***

# BLAND ENVIRONMENTS

By HENRY L. LOGAN

IN THE FIELD of architecture and interior design, lighting problems arise constantly. They are important problems, for seeing is the central activity of all sighted human beings. Yet although standards have been set by engineering bodies and societies, the lighting and brightness problem is far from an adequate solution.

Lately, one aspect which I call "blandness" in lighting, has been coming more and more to the fore. Some recent technical papers have given support to the "literalists" who sincerely believe that a uniformly lighted, bland world is the best kind of a world. Some discerning observers are not quite so sure. The *Architectural Forum* in June 1959 says: "If literally interpreted the scientists' results could lead to a uniformly lighted environment . . . carried to its ultimate, this 'scientific' approach would produce a functional but highly bland environment. . . . This is not a desirable end. . . ."

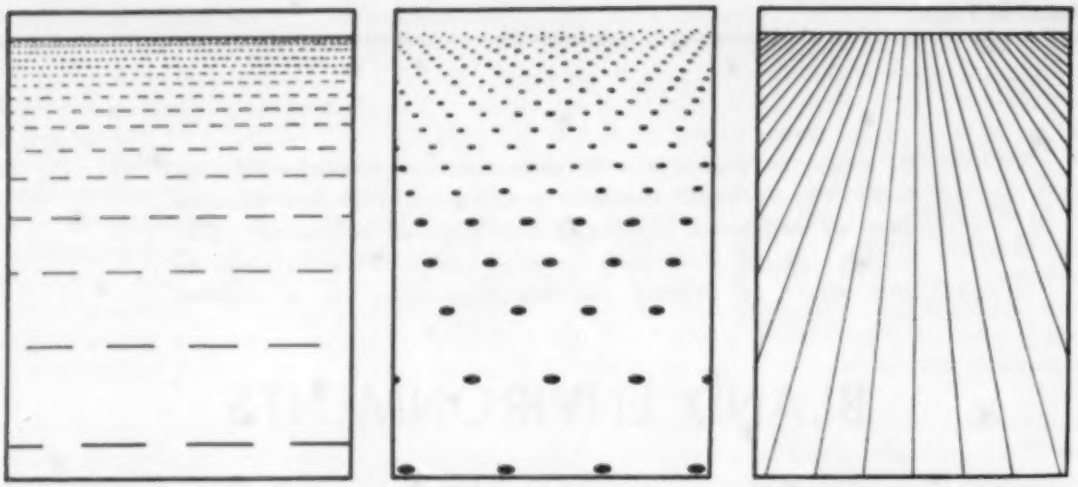
The view is expressed, in the January 1960 issue of *Light and Lighting* (London), that "general lighting from ceiling level with fluorescent tubes gives an undesirable and unpleasant shadowless effect. Very little diversity and very much diffusion are as undesirable as their opposites." The June 1959 issue of *IES Lighting Review* (Melbourne) says: "Rhythm carried to excess becomes monotony . . . the unrelieved endless pattern of windows (or fixtures repeated ad nauseum, is plainly monotonous." Many other appropriate quotations could be given, but the preceding show that the problem is international in scope; and if these views are valid with respect to bare fluorescent tubes, or repeated lines of fluorescent fixtures, they apply with still greater force to wall-to-wall, diffusing, luminous ceilings.

The London magazine previously referred to hazards a partial reason for the recent emergence of a widespread belief that there is something wanting in modern lighting methods by pointing out "that supplementary local lighting is commonly used when the general level of illumination is low and this affords some welcome diversity in the luminous field. When the general level of illumination is high, local lighting is less likely to be used, and when it is it contributes little to the diversity in the general field of view."

The fact emerges that monotony and blandness must be counteracted by diversity. Speaking broadly, bland environments are the result of an unimaginative, too-literal sticking to brightness-contrast "rules," combined with the use of overly diffusing lighting distributions, from equipment of such great size, or laid out in such repetitive pattern, as to be monotonous.

Brightness-contrast rules are good for tyros to follow and for experts to break. It is said of Mozart that one day a student complained about the master's insistence on a thorough grounding in the rules of musical composition: "You break them every day so why should I waste time learning

AUTHOR: Vice-President in Charge of Research, Holophane Company, Inc., New York, N. Y.


GRADIENT GIVING IMPRESSION OF CONTINUOUS DISTANCE.
GRADIENT GIVING IMPRESSION OF A LONGITUDINAL SURFACE.
EFFECT OF A WIDTH GRADIENT OR LINEAR PERSPECTIVE.

*From "The Perception of the Visual World" by J. J. Gibson*

**Figure 1. Visual Gradients.**

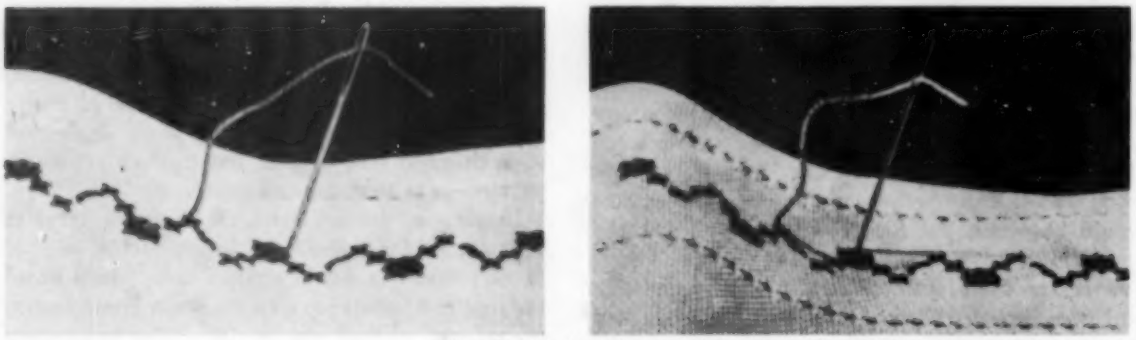
them?" "Young man," said Mozart, "I learned the rules forwards and backwards—so I would know *when* and *how* to break them!"

Architects above all know that light design is *visual* design, and they are experts in visual design. Their expertness and experience fully qualifies them to judge when to follow and when to break the "rules" set up by lighting committees. They can recognize the wise principles behind the arbitrary rules, and can apply the principles where the rules break down; and that they are breaking down is obvious today all over the world. This, by the way, illustrates how rules, like the "3 to 1" ratio, the "scissors" curve, and so on, when frozen into legal codes can become obstacles to progress. If such codes were wise guides, confined to setting forth lighting principles, they could never become the present strait-jackets for designers.

A strict adherence to the "rules" will give a comfortable environment; but it will be a *not*-environment; not-creative, not-varied, not-interesting, and usually not as clear as it could be. Usually equal visibility could be secured with less light properly directed.

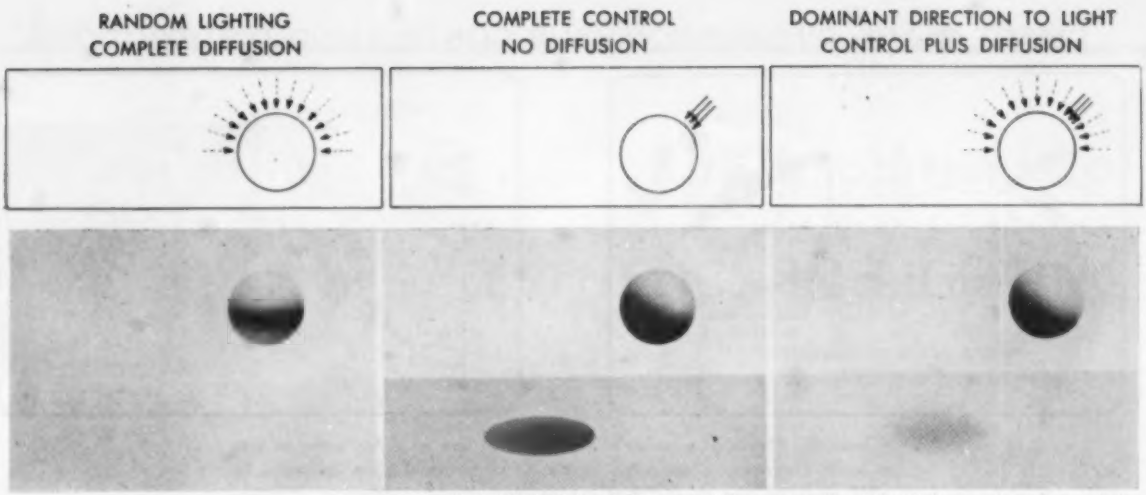
This is because the "rules" put a premium on diffusion, and diffusion is the great equalizer. Its effect is towards flattening out the field of view.

Mr. G. P. Wakefield wrote Mr. Willard Allphin, with reference to the then forthcoming Office Lighting Practice, "I believe we are morally obligated to be more than scientific." However, if the rules were only truly scientific it would help, as then they would be fully based on the operation of the visual process. As it is, the fact that the eye operates on the basis of visual gradients, as well as image recognition, is ignored. The three diagrams in Fig. 1, and the picture at right in Fig. 2, show some of these visual gradients. It is easy to wipe



*After "Elektisk Lys I Klasserum" Kommission Hos Teknisk Forlag, Copenhagen, 1958.*

**Figure 2.**




*After "Elektisk Lys I Klasserum" Kommission Hos Teknisk Forlag, Copenhagen, 1958.*

**Figure 3.**

them out with too much diffused light, as has happened in the picture at left in Fig. 2.

Image recognition may not sharpen past a certain level, but finer and finer differences in visual gradients may be discerned with rising light levels. This increases information recovery of the sort that makes seeing easier, more relaxed, and more interesting: provided the increasing light has a large element of directional control. This general principle is illustrated in Fig. 3.

The Bulletin of the National Institute for Architectural Education, Vol. 35, No. 1, page 5, stated, "the importance of directional light for the discernment of three-dimensional form has been generally known; however the importance of directional light in observing contrasting values on an apparently flat, matte surface . . . has until now been disregarded. These tests (of Professor D. H. Finch), disclose that the whole conception of lighting design as practiced from the basis of footcandle values on the horizontal plane is in error, for it was generally considered that by raising the levels of general illumination, visibility was greatly enhanced—*regardless of the direction of the light.*"

In short, control of the directions of the light is essential in order to sharpen up, instead of flattening out the field of view; to reveal the field in its full wealth of intrinsic detail and varied interest.

Fig. 4 shows the "flattening out" effect in a bank interior, as caught by a camera across the street. The left picture shows a model of the project, with the sharp, clear lighting effect that was anticipated. The use of the massive, metal screen, as a focus of interest at the rear of the principal area was well-calculated to add to the interest of the viewer. The right picture shows that the screen and other interior details have been apparently washed out, in the real-life finished

**Figure 4.**

## DIRECT GLARE: DIFFUSING VERSUS CONTROLLING DISTRIBUTIONS

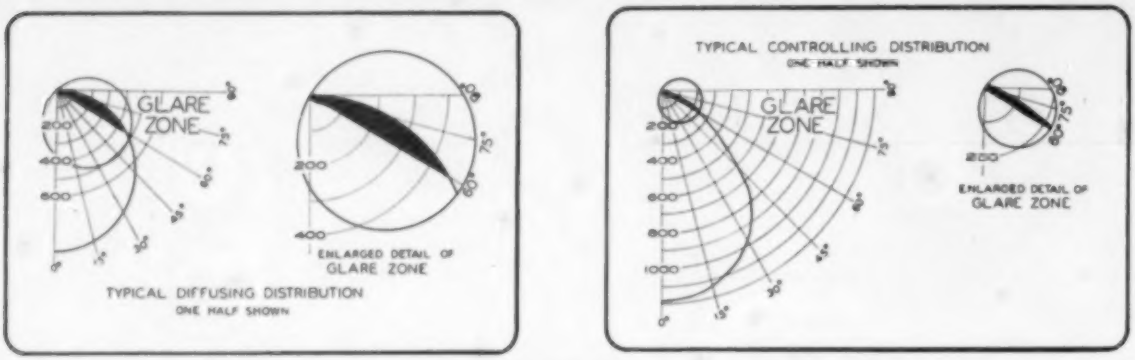



**Figure 5. Above photometric distributions are to same scale at left in each diagram. Glare zone details at right have been enlarged in each diagram for clarity, but are to same scale. Diffusing distributions have from 3 to 7 times the glare light of controlling distributions.**

building. The degree of flattening recorded by the camera may not be quite the same that the eye would see, but the pictures serve well to illustrate the fact that some flattening occurs when an entire, large ceiling is covered with diffusing media.

All of this is so incontrovertibly true that it raises the question, "Why should diffusion be so widely applied in artificial lighting?" One reason is that diffusion is comfortable at low levels of light, and low levels of artificial light have been the practice until lately. With today's rising lighting levels the situation is different. The "Visual Comfort Index" booklet of Meaker and Oetting shows the change in direct glare response, as estimated by their method, for luminous diffusing ceilings as lighting level rises. A luminous ceiling lighting system, for example, which they estimate would have a comfort response of 97 per cent at 10 footcandles, would have 80 per cent at 50 footcandles, 51 per cent at 100, 33 per cent at 125 and 14 per cent at 150 footcandles.

We do not have to agree with these precise estimates, but they are a true indication of the *trend* to less visual comfort as lighting levels rise, when diffusing techniques are employed. People can only tolerate so much direct glare, most at low levels, less at medium levels, and low toleration at high lighting levels. Therefore, the proportion of light sent in direct glare-causing directions should be progressively decreased as lighting levels rise, forcing use of narrower photometric distributions.

Fig. 5 shows in some detail the drop in light in the glare zone, when a controlled distribution is used in which the maximum candlepower drops to 50 per cent at 45 degrees. Glare response estimates give this type of distribution a visual comfort figure of 90 per cent at 150 footcandles, under the same conditions in which the estimate is 14 per cent for a diffusing distribution (shown at left of Fig. 5), at the same lighting level.

We have seen that the remedy for blandness requires the introduction of *diversity*. As the function of the lighting engineer is confined to lighting a scene, his job becomes one of revealing the natural wealth of detail, and the many varied aspects that actually exist, but which may be suppressed by ratio-bound, so-called "comfortable" lighting techniques. This means the sharpening instead of the reducing of contrasts; and particularly the sharpening of contrasts that reveal fine-grained gradients, upon which so much of the pleasure of seeing depends.

This may be accomplished by exercising control over the directions in which the light is emitted from the lighting equipment; and best results may very well come from combining the proper control with some pre-determined degree of polarization.

We have also seen that direct glare becomes an increasingly greater problem as lighting levels rise, and that the same techniques—the introduction of directional controls on the emitted light from light sources can also take care of this.

So my answer to the complaint of bland environments, as far as this effect is the result of current lighting practices, is to apply "control" methods of releasing light into architectural space. This may, at first glance, seem an over-simplification; but the more one analyzes what is happening in bland environments—the reduction of contrasts—reduction of potentially revealable visual information—and the creation of an exaggerated appearance of sameness in an architectural space—the obvious *first step* open to the lighting engineer is to reduce the degree of diffusion he is now using.

# The Importance of ESTHETICS IN LIGHTING

By ABE H. FEDER

***No one is more qualified to comment on esthetics in lighting than Abe Feder. His name is practically synonymous with this aspect of lighting. His original designs—from stage effects to outdoor lighting—usually speak for him—but here are a few of his thoughts on the importance of esthetics in lighting.***

LIGHT IS NOT a comfortably solid article like a building or a hat or a statue. If it were, there would hardly be a need to point up the importance of the esthetics of lighting, since it is everywhere in our lives. Beauty may not need selling where the places we live in are concerned, or the clothes we wear, or the objets d'art we live with —but light is another story. We don't believe it has much to do with us personally.

The trouble with light is that so few people can see it. Switch on a bulb and for all purposes it doesn't produce light, but a bookcase, a rug, a wall. Awareness of light as something with its own identity is gone as soon as the need for it is satisfied.

This very characteristic of light, the way it disappears from our consciousness even while we are looking at it, makes it difficult to conceive of it as a something, let alone a beautiful something. We are willing to settle for the simplest way of getting some light because, we say, all we want to do is to see. We find it almost impossible to visualize in our mind's eye different kinds of light, and hence almost any kind is acceptable. The fact is, however, that the kind of light we choose determines to a great extent how we see the home and the clothes and the objets d'art which we have picked with such meticulous care. With our indifference to the kind of light we see in, we negate much of the beauty we live in.

When light is used for spectacles, as in fountains, everyone sees it. When light is used decoratively, as in the luminous frame of a shop window, again everyone sees it. These are the more obvious aspects of the use of light as a design material, and there is a growing awareness of how light, when used in these ways, can provide esthetic pleasures as well as draw attention. These are the uses of light for the "looking at" experiences, where the objects are set apart from our personal spheres.

What we still lack, however, is a comparable awareness of light as a design material for the "living" experiences, the daily walking and sitting and eating and looking which each of us knows only as an individual. This is where we are not spectators, but doers; this is the major part of our lives. The esthetics of lighting are more important here where people are more personally concerned.

Light is a material through which we come to other materials; there is no way of arriving at anything, visually, without the medium of light. It does not obstruct, since other objects move through it freely. In turn, it covers every object set within it, so that when we pin-point light in relation to how we see, we are talking of the material that covers all objects reflecting their images back to our eyes. Therefore we are not talking of either bulbs or fixtures. Light is the starting point, but unfortunately, most lighting designs are begun by the choice of fixtures and the lamps they house.

Beautiful fixtures add to the decor, but the light they produce may be ugly. So often in articles on a particular bit of architecture, we read a rather

AUTHOR: Lighting by Feder, Lighting Consultants, New York, N. Y.

smug statement that goes something like this: "And as for the lighting, the fixtures were carefully selected to be consistent with the architectural design." Not a word about the choice of the light itself. The fixtures belong only to decor as far as their appearance is concerned. What we want is to deal with light, the material that affects the appearance of everything else.

What makes light a matter of esthetics? For one thing, it can be beautiful and satisfying in itself, as when, for example, a room is literally filled with a warm radiant light so that people feel impelled to walk into it, as they feel about sunshine. For another, light has an esthetic value insofar as it adds an element of beauty in the way our eye records an image. Reduced to human terms, where it belongs, esthetic lighting makes people look and feel their best, and adds lucidity and appeal to the objects they live with. If we forget about people and relegate light to the mechanical only, the lumens per watt, the level of illumination, the ceiling heights, we have lost our perspective. Without people we don't need light. Like everything else, it belongs to them first and to science second.

Remembering that every person and every object is seen only through light, we realize that the lighting must always contain and provide some esthetic value. That beautiful home is as nothing, if we don't cover it with an appealing light. A sickly patina over a rich rosewood desk produces a sickly desk. A harsh light in an office will not make that office seem a good place to be. A faintly blue-green light from overhead in a hospital room, no matter how handsome the fixture, is not going to make the patient look and, hence, feel he's going to get well. Wherever there are people, there is the problem of esthetics in lighting.

In a warm light which flatters their skin tones, and in a light which hits them at flattering angles without distorting their facial contours with shadows, people tend to feel expansive. Women in particular feel best knowing they look well. As women are half of us, or thereabouts, this is not a mere point of vanity, but an important lighting fact.

Turning to objects, we react emotionally to what we see, up and down the scale, depending on how they appear to us. Clothes, food, furniture, typewriters, sewing machines, telephones, drafting boards, all of these look best in certain kinds of light. This too is an important lighting fact, as uninviting-looking objects have a depressing effect.

Each lighting design begins with people and their activities and their reactions. What will they be doing in this particular area? If it is eating, then the food has to look appetizing and fresh, and the kind of light chosen is one in which meat, for example, doesn't look green. The light sources are focused on the table where the food will be placed so that the surprisingly extensive acts of spearing and cutting and spooning which form part of the process of eating, can be done comfortably, where both utensils and food can be seen. But the angles of the light sources are such that the look of those eating is not sacrificed to that of the food.

Wherever eating, talking, playing is concerned —anything that involves people in their daily lives —we are talking about lighting that has to be lived in. There is more of this kind of lighting necessary than for the "looking at" kind of thing, the spectacle and the show. I point all this out, although it may seem obvious once it is put into words, because too often we're not designing as though it were obvious. We confine the esthetics of lighting to lobbies, night clubs, beauty salons and the like, and turn the rest of the lighting into a matter of mechanics.

Light doesn't exist in space. Unfortunately, it comes in enclosed glass cases from which it cannot be removed except as it was specifically intended to be removed. One lamp will produce a narrow beam and no more. Another lamp will produce a diffuse radiation and no more. Therefore the use of light is seemingly limited, often inflexible, and therefore, by its nature a matter of mechanics. But the way to start is to ignore the lamps and to begin with light itself, using it as an endlessly pliable material, and spreading it out in an area with whatever intensity, pattern and variety is called for. Then we match each piece of light, quite literally, to the bulb that comes nearest to producing the specific effect we need. But essentially, again, we relate light to people, the things they do and the things they use.

We hear a great deal today about architectural lighting. What this means is the kind of light we use in a given area to define its layout and design. I have chosen to ignore this aspect of lighting, although it is very important indeed, because when we think of buildings nowadays, we seem to lose sight of the very people for whom they are supposedly built. Everyone seems reduced to an automaton which marches into a lobby, into an elevator, and is spewed out at one floor or another, possibly right into the sky. In terms of the building, it couldn't matter less. The scale of architecture today is hard to bring down to human values, for in our cities at least, we've turned life over to the mechanical sciences. It would be a pity if lighting design, which we are just beginning to rescue from the sphere of statistics, were to follow suit. The important thing about esthetics in architecture or in lighting or in a wedding of the two, is that there *isn't* any unless the design has a value to us as human beings, not as inanimate spectators.

# WHITE LIGHT—What Is It?

***Some years ago Mr. Williams commenced a lighting lecture with the statement that "there is no such thing as simple white light." The same statement constitutes the opening sentence in the first of his textbook publications on lighting. It seems to him that the basic importance of this statement has in no way diminished with time, but is rather brought into sharper focus by today's rapid progress towards higher illumination levels and our greater knowledge concerning brightness relationships and visual performance.***

By ROLLO GILLESPIE WILLIAMS

THE DESIGN OF lighting installations for required footcandle values and with regard for such factors as discomfort glare, reflected glare, brightness ratios, but without consideration of the factor of color in lighting, may tend to produce an attitude toward light that implies that it is colorless, *i.e.* white. Certainly much of the available data on illumination—although by omission rather than intent—deals with light as though it were achromatic or colorless.

Color in lighting is far from being just an esthetic factor that does not enter into the scientific aspects of illumination. On the contrary, color in the sense of spectral quality is an important basic fundamental of both light and the illumination that results from it.

Proper consideration of spectral quality will show, for example, that a given footcandle density from one type of light source may not provide such a high surface luminance in some instances as the same footcandle density from another type of light source. In this instance, a matter of practical import is involved, that affects the economies of lighting, hence its value is easier to assess than that of other equally important but less easily rated factors such as color rendition, color contrast and color adaptation of the eye.

To be interested in light from the standpoint of brightness alone, is like dealing with color and considering only one of its three basic characteristics—hue, saturation and brightness. If light were basically "simple white light" we would be normally living in a world of black and white, similar to black and white motion pictures, instead of a world of color.

The majority of people engaged in the business of illuminating engineering are not involved in work that directly relates to the spectral distribution of radiant energy, and consequently many of them find it helpful to be reminded of the basic facts of light and vision. A brief review of these facts is now given before proceeding to discuss the effects of different spectral qualities of "white" light.

The wavelength theory of light shows that radiant energy is emitted by a light source in the form of waves, and that those that initiate vision range between 380-760 millimicrons in wavelength. Each single wavelength in this spectral range causes the cone receptors in the retina to produce a sensation of color. The perceived color hue varies with each wavelength and the resultant colors are seen in the rainbow. They are known as the colors of the visible spectrum and include red, orange, yellow, green, peacock-blue, turquoise, blue and violet.

Consideration of the spectrum reveals two interesting facts, namely (a) the color range is incomplete since it lacks the important range of purple hues, and (b) that not one single wavelength produces WHITE light.

Analysis of the color sensations produced by the retinal cone receptors shows that all the spectral hues can be found to be the product of three pri-

AUTHOR: Director of Color Research and Lighting Consultant, Century Lighting, Inc., New York, N. Y.

mary color sensations, namely red, green, and blue. Tri-chromatic color theory shows that these sensations correspond to three types of cone receptors, each with a different response to spectral energy wavelengths. Each type of cone receptor gives maximum response at a specific wavelength in the visible spectrum, and falls off in response as the change in wavelength on either side in the spectrum gets greater. Thus there are three parts of the spectrum where one set of cone receptors is giving a high response compared with the relatively lower response of the other two sets of receptors. Under these conditions the perceived hues will normally correspond to one of the primary colors—red, green, or blue. At other parts of the spectrum the response from two sets of cones will dominate the response of the third set and the hues here in between red, green and blue will be perceived, namely orange, yellow, peacock-blue, and violet, etc.

When the responses of all three sets of cones are equal (or nearly equal) then the additive result of the three sensations red, green and blue is seen as WHITE. But there is no single point in the wavelength range of the visible spectrum where all cone receptors are equally stimulated — hence *white* light, unlike color, cannot be produced by a single wavelength. White is a phenomenon of vision resulting from the additive effect of the three primary color sensations—red, green, and blue.

It is commonly believed that the wavelength range of the whole spectrum is required to produce a normal appearance of white, but this is not correct. Any combination of wavelengths that equally (or nearly equally) stimulates the three types of cone receptors, will normally produce the appearance of white. This can even be done with two single wavelengths when the combined effect of their brightness values is to equally stimulate all cone receptors. Thus wavelength 570 m$\mu$ almost equally stimulates the two types of cones that provide the red and green sensations, while wavelength 443 m$\mu$ strongly stimulates the receptors that produce the blue sensation. Other examples of complementary wavelengths are 650 m$\mu$ and 496 m$\mu$, 580 m$\mu$ and 482.5 m$\mu$.

It is important to remember that there is a big difference between the *appearance* of white and its *color rendition* qualities. When an object depends upon reflectance to be seen, and has equal reflectance characteristics at all wavelengths, then there is no problem—but when an object has color selectivity then its appearance may change with the spectral quality of the incident light. Two or more "whites" that are identical in appearance may be quite different in color renditional qualities.

Thus a green object with a reflectance range of 500-600 millimicrons will appear green under a "white" illuminant with a normal content of these wavelengths, but will appear yellow-green if seen under another illuminant providing white light of exactly the same appearance but containing much more energy at wavelengths 550-600 m$\mu$ than 500-550 m$\mu$. Now if the object in question is illuminated by a white light containing only the pair of complementary wavelengths 650 m$\mu$ and 496 m$\mu$ mentioned above, then the green will appear as *black*. This is because there are no wavelengths in the light that correspond to the reflectance characteristics of the object. Thus we find a situation where a normal color cannot be seen at all under a *white* light, because of the spectral composition of the light.

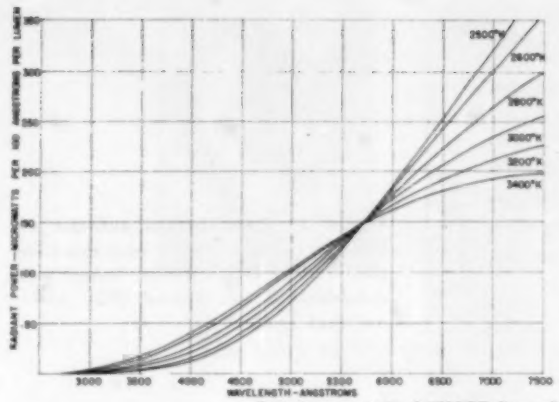
There are a limitless number of combinations of wavelength values that can combine to produce a white of the same appearance value, but many of these whites will be very different in their color renditional qualities. A well known example is seen with the standard cool white and deluxe cool white fluorescent tubes, which provide light of almost exactly the same appearance but with quite different color renditional qualities.

The concept of light as achromatic and without color content, may also lead to less efficient means of obtaining given brightness values. When colored rather than white or gray surfaces are concerned, there are many instances where light sources of high lumen output will result in poorer reflectance values than can be obtained with other light sources of lower lumen efficiency but different spectral distribution. Thus the footlambert values of red or orange surfaces seen under a 100-watt clear glass type mercury lamp with an initial lumen output of 35 lumens per watt will be much lower than that obtained under an improved-color 100-watt mercury lamp with an initial lumen rating of 33 lumens per watt. A saturated cyan blue surface will give a higher footlambert reading under a given footcandle density of fluorescent light from fluorescent daylight lamps (58 lumens per watt) compared with light from the same number of standard warm white tubes (67 lumens per watt).

There are many methods of varying the spectral distribution of white light, of which the best known is probably the use of color filters in conjunction with the light sources. Other methods include:

(a) The use of two or more different types of light sources as, for example, incandescent filament and fluorescent lamps, in a luminaire to provide a blended light.

(b) When incandescent filament lamps alone are employed, a certain amount of change in spectral distribution can be produced by varying the voltage supply to the lamps by means of dimmers.




*Drawing courtesy of SMPTE Journal*

**Figure 1. Spectral distributions for various color temperatures of tungsten filament lamps.**

(c) Spectral quality can be controlled within wide limits by using an additive color mixing system to provide the illumination, so that by blending certain basic colors, as for example, red, green and blue in different proportions, every required hue of color at any desired degree of saturation can be obtained, including deep colors, pale tints, and "whites."

The "whites" produced by such an additive lighting system are particularly good for providing strong color rendition from reflective colored surfaces, although the wattage required for a given footcandle density is much higher than would normally be required for white lighting.

With method (b) a reduction of voltage not only reduces the lumen output of the lamp but also reduces the color temperature rating of the emitted light. Fig. 1 shows how the spectral distribution of the light varies with different color temperatures. As the K° rating decreases, the proportion of red to blue light in the spectral distribution increases, so that the light becomes yellower in appearance and loses much of its rendition power for colors at the blue end of the spectrum. Conversely increase of color temperature rating increases the proportion of blue to red light in the spectral distribution.

In methods (b) and (c) above, the use of brightness controls in the form of dimmers is essential, while in method (a) they are usually an advantage. Dimmers are no longer a prerogative of stage lighting, and today they are widely used for architectural, display and color renditional effects.

A new type of remotely controlled dimmer known as the controlled rectifier-type dimmer has recently been developed, and offers many advantages for work of this kind. It is relatively small, lightweight and compact, and requires only a minute control current that is regulated from a small remotely located control unit, in order to regulate large lighting loads from full light to black out. Fig. 2 illustrates a C-Core controlled rectifier-type dimmer unit which is available in sizes 2-12 kw. The dimmer can be accommodated in the most convenient position for the electrical system, while the small operational controller can be located in the best place for control of the light. Low voltage wiring between the dimmer and its controller is required to carry only one milliamp at 28 volts. A dimmer of this type is ideal for controlling lighting intensities as (b) and (c) above in architectural, institutional and display lighting.

So far the appearance of white or color in illumination has been related to the spectral distribution of the light. However, there is another factor, namely simultaneous contrast, that can change the apparent color values, independently of spectral quality. Simultaneous contrast concerns the mutual relationship of contrasting colors that are viewed simultaneously. The contrast effect can produce a very marked change of hue, and can even cause a white area lighted with normal white light to take on a pronounced color appearance. This can be easily demonstrated by viewing an area illuminated with white light in the center of a field of colored light. Appropriate changes in the hue and intensity of the colored surround area will cause the white area to take on an appearance of color, which will change from blue, to red, to green, to pink, etc., as the contrast values in the surround area are varied.

"White" light can take on a pronounced color appearance under certain contrast conditions.

This phenomena can be turned to useful account in many ways. For example, Fig. 3 shows a 12-foot-

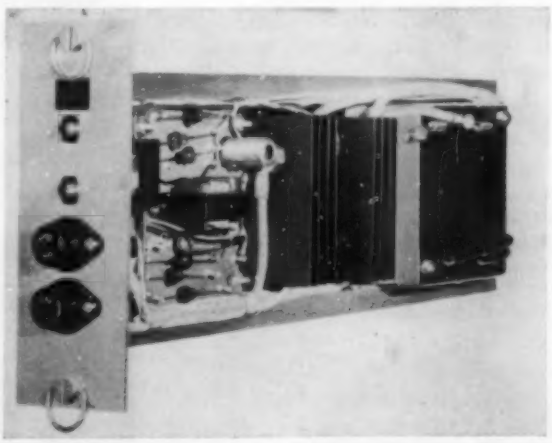
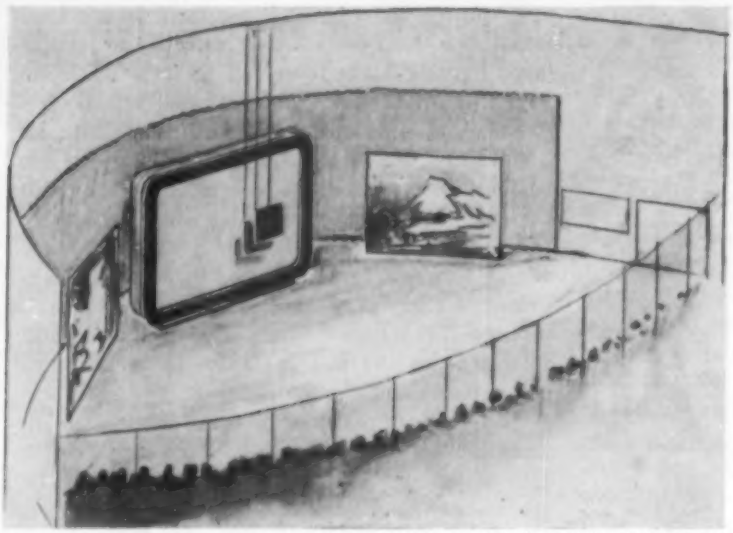



**Figure 2. C-core silicon controlled rectifier-type dimmer which is available for remote control in sizes 2-12 kw.**



Drawing courtesy of Cushing & Nevell, Designers

**Figure 3. Simultaneous contrast effects were demonstrated with this Century 12- by 8-foot Color Value Wall exhibited at the Tokyo 1957 International Trade Fair.**

wide Century Color Value Wall as exhibited by the U. S. Department of Commerce in the T.V. Color Exhibition in the Tokyo 1957 International Trade Fair. The translucent area can be lighted up in a diffused color of any desired hue or tint at very high brightness levels. The suspended panels seen in front of the luminous wall are independently lighted with white light, but change considerably in color appearance by contrast effect alone when the luminous background is varied in hue and brightness. Variable color areas of this type have been extensively used during recent years for architectural and display work and in photographic and television studios.

Returning to the opening remarks in this paper, it will be seen that indeed there is no such thing as "simple white light." Vision is initiated by radiant energy, and in consequence, single wavelengths are seen as color and certain wavelength combinations produce the appearance of "white." The color or "white" that is finally perceived, however, will be influenced by such factors as simultaneous contrast and the color adaptation of the eye. The color renditional properties of an illuminant, however, depend upon its spectral distribution.

Neither colors nor white have any absolute appearance and the final interpretation of any set of wavelength values pictured upon the retina of the eye, depend upon psychological as well as physiological factors. However, it is very important to commence rightly, and the starting point for correct consideration of color appearance and rendition is knowledge of the spectral distribution of the incident light.

**Figure 4. Several different qualities of white light were combined in the lighting for the lobby of the Royal York Hotel, Toronto.**

# An Interview with Gyorgy Kepes

***In a recent interview, Professor Gyorgy Kepes of the Massachusetts Institute of Technology, the famous designer, emphasized three concepts of particular interest and concern to lighting engineers. These were: legibility of space, unity with variety and sequence of experience.***

**Legibility of Space**—Lighting is a major contributor to the legibility of space since only through light can we quickly and adequately reveal form, particularly in large scale.

This translation of space can be either for orientation or mood—the physiognomic quality of space—or often for both. For purposes of orientation, light gives us the appearance of form and texture so necessary for establishing the spatial relationships of our visual environment. In designing lighting to achieve orientation, the lighting engineer has done fairly well, but when it comes to lighting for moods he tends to be timid—perhaps with reason. The first step of design—crisp, clean, legible interiors, for example—has been taken, but the next step is more sophisticated, more expressive.

Stated another way, legibility of space involves information, expression and sensual delight. *Information* is the documentation of size, shape, direction, etc., which permits us to relate ourselves physically to the space. *Expression*, as used here, refers to the mood quality of a space (*e.g.*, dusk *vs.* dawn, gaiety *vs.* somberness). *Sensual delight* is the abstract, "musical" aspect of the space—its harmony, rhythm, balance, proportion.

**Unity with Variety**—Unity without variety is inadequate. A superficial approach to unity is achieved by orderliness, by sameness of size, shape, brightness, color, etc. Often very little is required for the introduction of the interest of variety. It may be a lone cloud in the sky or a small boat in an expanse of sea and sky. Lighting too can have unity, but without some variety it becomes sterile and monotonous.

**Sequence of Experience**—The importance of sequence of experience cannot be overestimated. Human beings have a tremendous capacity for automatic adjustment. We adapt ourselves to fairly wide ranges of heat, for example, and we are continually reminded that the feeling of warmth or coolness is not only the temperature of the moment but also of the sequence of temperatures preceding that moment. Similarly, for esthetic organization, every visual experience is a sequential experience. Stage, motion picture and television lighting engineers, who are required to create space, mood, etc., with light, depend heavily upon sequence for their results.

Perhaps the intensity and/or color of our lighting should be controlled automatically as is heat. We might, for example, use dimming equipment to continuously change the lighting between set limits, as thermostats regulate heat.

Professor Kepes also expressed the thought that light can introduce dynamic quality into a space. When asked whether the esthetic effect of lighting could be defined as something apart from the psychological effect, he expressed the thought that it could not, since the esthetic effect is part of the psychological effect.—GEORGE W. CLARK

Called by some "the most beautiful bank in the Midwest," Continental National in Lincoln, Nebraska, boasts a lighting system which is as integral a part of the total effect as are the Burma teak walls, Italian glass tile columns and Roman travertine floor. Luminous ceiling in the main banking area is 48 by 96 feet, with a 23- by 60-foot acoustic plaster island punctured by two columns. Main ceiling, 22½ feet high, uses 102 eight-foot fluorescent strips, 12 four-foot strips and 21 six-foot strips with plastic shielding media. Each column, rising to a 7- by 7-foot cut-out in the plaster island, is lighted by two 8-foot fluorescent strips.

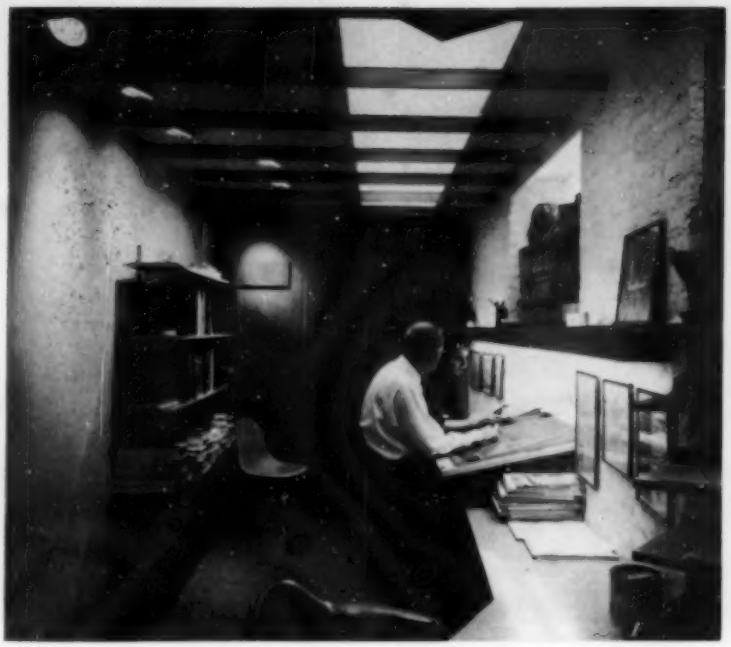
Luminous ceiling over the tellers' and officers' areas is supplemented by a simple yet pleasing lighting pattern in a lower-ceilinged section of Mutual Savings and Loan Association, Ft. Worth, Texas. A rectangle of recessed troffers with acrylic lens diffusers forms a border for the large surface-mounted unit highlighting the planter. Air diffusers, also enclosed by the rectangle of troffers, do not "float" randomly on the ceiling.

***A series of articles in IE in the summer of 1959 featured many "pre-Blackwell" installations which met the then-new IES recommended levels. So too with the next advance in lighting practice. A cross-country search uncovered a surprising number of installations which demonstrated the concern for esthetic effects. Those shown in this section are work areas where the science of illumination —footcandle levels, brightness ratios, reflectances, etc.—is inevitably the basic concern, but where interesting design has added psychological benefits and resulted in truly noteworthy installations.***

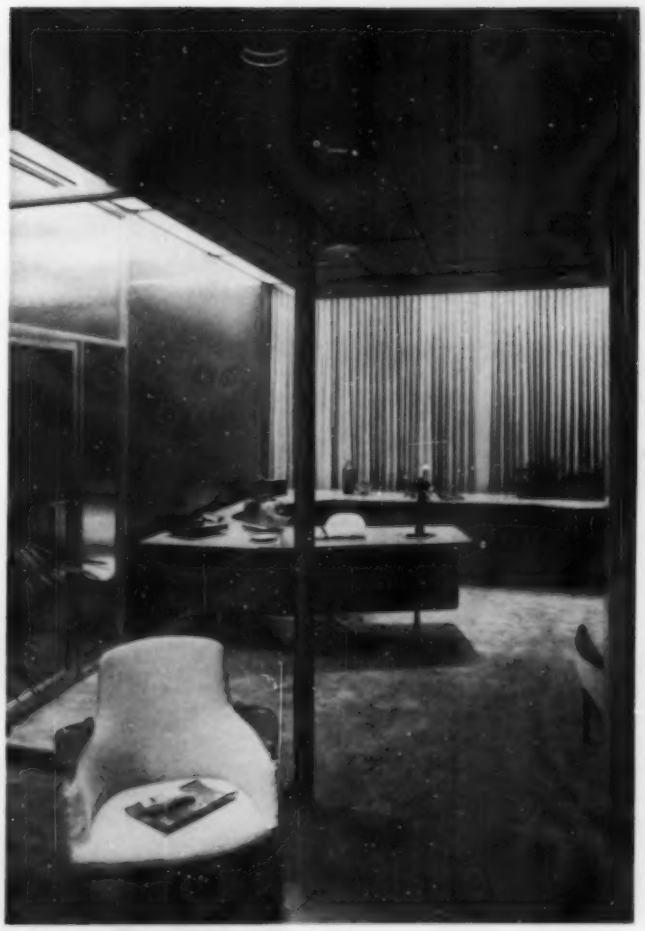
# *Spotlight on* SCIENCE

Transformation of a potentially "bland" rug-sized luminous ceiling into a decorative element at the North Side Savings Bank, Houston, Texas, is the result of the architect's awareness of the potential of lighting as an element of design. Modular two-foot luminous panels, using F96T12 cool white lamps on two-foot centers, and a plastic cell louver panel form the basis for the interesting design. Lamps are mounted at 18 feet, louver panels at 16 feet. Wooden border on the inside of the central square formed by the arrangement of lighting elements shields the lamps from view; wooden strips running from the border across the ceiling and down side walls add interest to the ceiling, connect it, decoratively, to the rest of the interior. Spill light from the fluorescent lamps and recessed spots provides light in the center of ceiling and over writing desks. Architect, E. D. Carter of Wylie W. Vale, Houston.

Large area surface-mounted units can simply be arranged in rows with spacing calculated for the most efficient lighting environment, or, as in the two offices shown here, the necessary illumination can be provided from interesting patterns of luminaires. In the executive office above, four-lamp units with acrylic refracting lenses arranged in a J-shaped pattern produce 140-150 fc on the desk, 120 at the telephone. Brightness from the seated position is 10 fL at 30 degrees, 20 fL at 45 degrees, with 110 fL on the task. Below, an L-shaped pattern of the same fixture, with another acrylic lens, around the perimeter of the room is combined with a small grouping of fixtures in the center of the room for a comfortable illumination level of 175 fc.



Lighting designed to compensate for physical problems converted a windowless, low-ceilinged corridor into esthetically pleasing, highly functional private office (above). At entranceway, panel of honeycomb aluminum louvers in a wood frame is suspended below 40-watt rapid-start fluorescent lamps recessed into 3½-inch metal channels, painted flat white on the inside. Attractive design with a functional purpose, this dropped panel makes office ceiling, by contrast, appear higher. General lighting element in the office proper, two-lamp side-mounted fluorescent channels with aluminum honeycomb louvers, is crossed by one-by-three-inch wood strips, on 24-inch centers, a unifying decorative element which makes the ceiling appear wider. Single fluorescent channel with 40-watt rapid-start lamps creates impression of a window in the alcove above the drafting board; recessed eye-ball spots directed at opposite wall form patterns of light and shade, add another lighting dimension to the room.



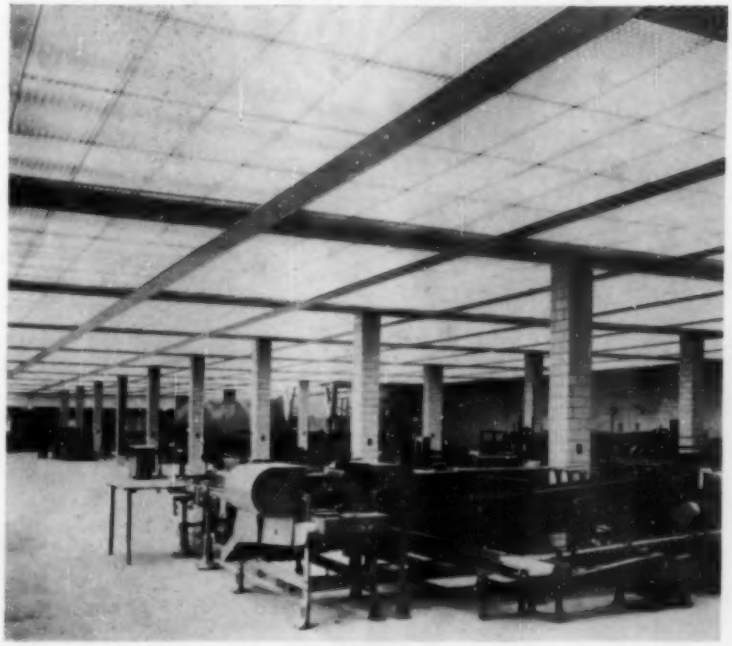
Unobtrusively fused with the decor in this executive secretary's office (right) at General Motors Technical Center, Detroit, the lighting provides footcandles with more than lip-service to esthetic design. Dropped ceiling is lamped with 150-watt R40 recessed spots; perimeter lighting is from continuous row of three-lamp fluorescent units. Measured illumination level on desk is 150 fc; 40 fc around the perimeter encircle the area in light.

Distinctive in a maze of stores in Northland Shopping Center, Detroit, is Great Lakes Seafood shop where a luminous ceiling element flowing into a green luminous wall creates a shopper-stopping display. Ceiling uses white fluorescent lamps, one to each section, above diffusing plastic. Green lamps behind plastic on wall form an appropriate background for the fish motif. Two staggered rows of concentric louvered recessed spots around perimeter highlight special displays.

Most interesting decorative element in Dayton's Shoe Store, Southdale Shopping Center, Minneapolis (left) is also a functional one—the lighting. Custom-designed light wheels with 40-watt cool white fluorescent lamps above diffusing plastic provide general illumination level of 50 fc. An indirect component with four 100-watt inside frosted incandescent lamps, suspended below each fixture, lights the potentially dark central area for good brightness ratios.

Decorated suspended fluorescent fixtures add interest to an otherwise routine installation in Sanders Bakery and Confectionery, Northland Shopping Center (right). Four cross members embellished with a simple design supply uplight only. Downlight is from ceiling recessed two-lamp fluorescent units; two-lamp units along one wall give both up and down light. For feature displays in wall niches, there is a wall valance with a double row of F40T12 lamps.

The 15-watt inside frosted decorative lamps mounted on this arched canopy in Dayton's Beauty Shop, Minneapolis, give another dimension to the canopy, add the warmth of incandescent lighting to this essentially decorative element which accents the passageway. Functional lighting is a neat pattern of flush-mounted direct-indirect units with 300-watt IF lamps on 5- by 8-foot centers. Over the mirrors are two rows of cool white 40-watt fluorescent lamps.



Early realization of the psychological advantage of an esthetic lighting design is this 1953 installation in Mennen Co. packaging plant, Morristown, N. J. To break monotony of a huge (19,200 square feet) expanse of luminous ceiling, a pleasing pattern of acoustic tile and low brightness green louvers was designed into the system. Lighting is supplied by 96T12 lamps on 32-inch centers above a 16- by 18-foot grid system using white metal louvers with 45- by 45-degree shielding. An outside wall (not visible), constructed of light-directing glass block above eye-level, light diffusing glass block below eye-level, contributes to the effectiveness of the illumination.

Relative nature of esthetic lighting design is demonstrated by these two industrial installations. While both would be standard designs in office areas, they have the psychological advantage of adding "class" to the factories, while concealing structural "eyesores." At Davis & Geck Laboratories (above), surgical suture manufacturers, a luminous ceiling with rows of F40T12 cool white rapid-start lamps on three-foot centers above corrugated plastic is broken by pattern of baffles. Parker Pen Co. factory, Janesville, Wis. (below) has three-lamp glass-enclosed troffers recessed in grid-type suspended ceiling.

***Much as the architect uses marble, tinted glass, bronzed aluminum for their beauty rather than for any functional considerations, the illuminating engineer must often use light as an artistic medium. In homes, public buildings, churches, restaurants—wherever it is necessary to create a mood, evoke a sensual response, lighting design is essentially an art, to be fused with the other elements of visual design for an esthetically-pleasing environment.***

Nighttime architecture, almost wholly dependent upon lighting, is an increasingly important consideration in "prestige" buildings across the country. In the bronze Seagram Building, added to the New York skyline in 1958, a luminous ceiling system using 40-watt 425-ma lamps is run at 120 ma by a separate nighttime circuit, making the building into a tower of light after working hours.

# *Accent on ART*

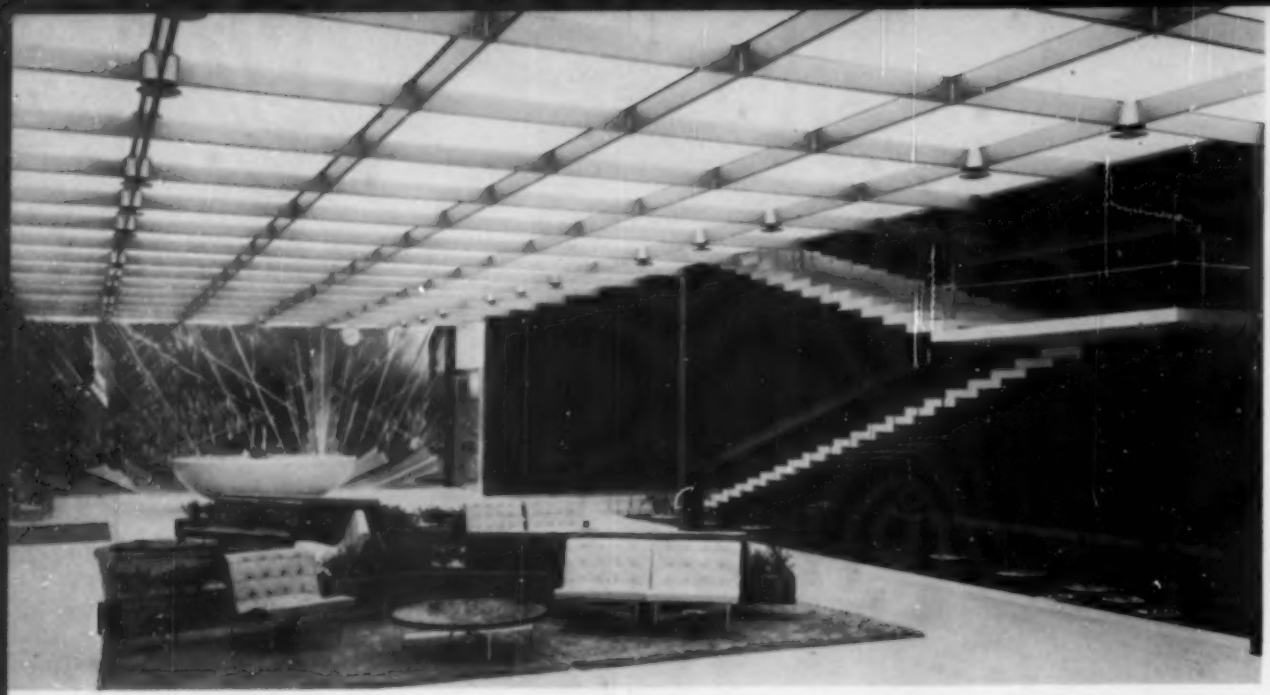
Play of light on the exterior of Las Vegas Convention Center makes the nighttime appearance of the architecture even more impressive than the daylight view. Subtle gradation of color on the underside of the huge dome—blue at the outer edge, green near the wall—is achieved by the use of a row of blue and a row of green T12 slimline fluorescent lamps in modified parabolic polished Alzak reflectors with Plexiglas weather-proof covers. Top of the dome, constructed of Alumilited aluminum, will be lighted by fifteen 277-volt, 1500-watt quartzline incandescent lamps in narrow beam projectors, mounted on 35-foot poles in adjacent parking areas. Plexiglas sign on front of building is lighted by high voltage white fluorescent tubing.

Dining room lighting design by Richard Kelly, using incandescent sources entirely, is combination of background glow, brilliant highlights. Five pinhole downlights having optical projectors with shutters illuminate marble table-top, adding sparkle to china and crystal. Ceiling suspended cross pieces are, in effect, miniature gold coves concealing miniature light sources which are reflected from the ceiling for a diffuse glow of light throughout the room. Painting is floodlighted from ceiling-mounted shield. Incandescent sources behind draperies filter through a second gauze which covers the drapes. All lighting is dimmer-controlled for subtle variation of effects.

Simple uses of standard equipment produce esthetic effect in living-dining room (above). Predominantly white drapery on two sides of dining area serves as background to reflect light into room from enclosed fluorescent-lighted cornice. Downlight over dining table used against this reflected light background accents table appointments. Planter room divider is highlighted by three ceiling-mounted downlights with 75-watt lamps shielded by white-lined box. Added benefit is favorable condition for plant growth under high illumination level.

Two views in New York apartment of interior designer Beverly Reitz (above and right) illustrate deft use of structural lighting for accent on decorative highlights. Attached to underside of beam over sofa, four cylindrical lights direct a muted accent on the paintings. Across the room, beautiful piece of sculpture displayed against strip of red fabric is highlighted from behind a false beam. At interesting intervals along the wall (right), this false beam which balances the real beam on the opposite side houses lighting niches over art groupings.

Structural and decorative lighting elements in balanced design (below) foster pleasing lighting environment. Pulley lamp, off-center, over furniture grouping contributes decorative and lighting accent; cornice lighting is used over bamboo curtain. Framed opening is not a niche but a lightly frosted glass wall dividing entrance hall from living room. Fluorescent lamps at top and bottom, shielded by frosted glass, make divider into a luminous wall, create interplay of light through glass shelves and colored art objects.



Reflecting the bold mood created by the serpentine staircase and mural in the lobby of the General Motors Technical Center in Detroit is this baffled luminous ceiling which combines lighting, ventilation, acoustic treatment and a sprinkling system. Ceiling, made from modular five-foot sections uses matte-surfaced Plexiglas diffusers below F40T17 cool white instant-start lamps, three lamps to each ceiling section.

Luminous panel sections, stainless steel panels and coffers were combined in a saw-tooth ceiling design by architect Claud Beelman in lobby of Tidewater Bldg., Los Angeles. Luminous panels at sides, providing highlights on planters and functional illumination at elevators, use fluorescent lamps suspended from 15-24 inches above diffusing plastic. Lobby is air conditioned through corrugated ceiling with space above luminous areas acting as plenum. Mural at left, designed by Nilos Bel-Jon, is of etched aluminum.

Design was primary consideration in lighting installation for Grand Lounge, Las Vegas Convention Center, and recessed downlights were arranged to echo pattern of stairways—an architectural highpoint. Units use 750-watt R52 floods mounted in deep conical Alzak aluminum reflectors which control brightness of light source and act as intensifiers. For background of light in huge lounge area, there are vertical coves with 40T12 warm white fluorescent lamps. Continuous row of R40 wall-washing units are for mural not yet installed.

Designed by one of the foremost American architects, Eero Saarinen, Saarinen and Associates, Bloomfield Hills, Mich., Christ Lutheran Church in Minneapolis combines brick walls, wood panels and unusual acoustical treatment for striking modern appearance. Light scoops for indirect ceiling illumination, jutting out from a side wall, high above the pews, reflect the bold lines of the architectural design. Pew lighting is from ceiling-recessed spots.

Sculpture in metal of Great Lakes, by Lily Saarinen, in Detroit shopping center, benefits from lighting. Finish of the metal, a light grey, is darkened and contrasts markedly with white concrete wall when light from four 150-watt PAR38 floods, hidden in shrubbery, is focused on grouping.

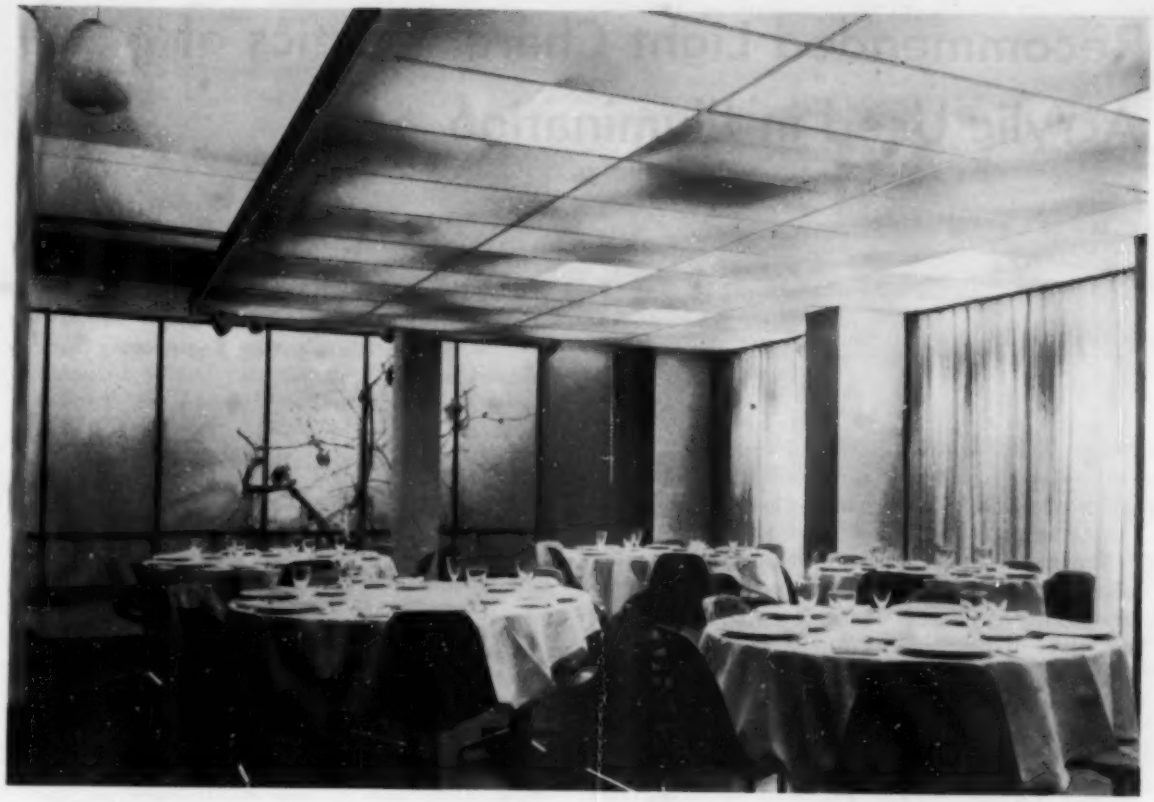
Simple technique of using cool, standard and warm white fluorescent lamps in concentric coves makes an interesting, easily achieved lighting effect in ballroom of Las Vegas Convention Center. Further color contrast and illumination is obtained from R40 floodlamps, in elliptical cones, mounted flush with the ceiling.

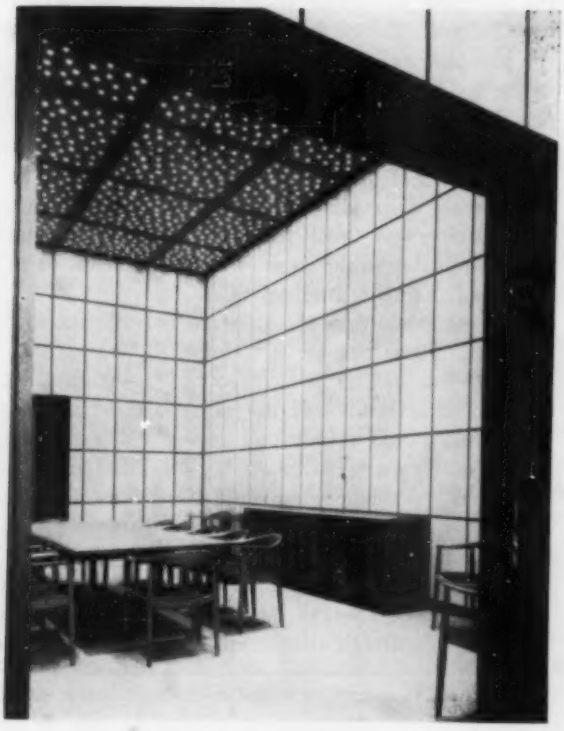
Subtle use of colored light (opposite page, top) can produce beautiful effects as in this restaurant where colored luminous wall forms background for decorative driftwood. Behind diffusing wall panels (opposite page, below left), are cool white deluxe, daylight and pink fluorescent lamps and a random pattern of blue and green incandescent lamps. Colored reflector lamps on baffles in front and above luminous wall create shadow patterns from the driftwood. Floating luminous ceiling has PAR38 floods, silvered-bowl lamps in regular patterns, colored R40's, colored sign lamps and, in two-foot square sections, deluxe cool white, deluxe warm white, colored fluorescent and colored filament lamps for an infinite variety of tones and moods.

Rich, simple, yet elegant warmth of a private dining room (opposite page, below right) at New York's Four Season's restaurant is heightened by twinkling starlight ceiling of hundreds of tiny recessed incandescent lamps. Warm brown tones of furniture and hardwood walls are accentuated even more when ceiling is dimmed to provide atmosphere for intimate parties. Designed by Richard Kelly.

Prestige restaurants, such as the Four Seasons in New York City, frequently depend as much upon their decor as upon their cuisine for their reputations. A major source of this room's glamour is consultant Richard Kelly's lighting design. Several systems of controlled light combine to provide a rich subtle atmosphere. French walnut walls and shimmering "watch chain" window draperies are washed with light from recessed dark-light troffers. This daytime photograph scarcely does justice to the truly spectacular effect achieved. Sense of luxury is further stimulated by glimmering gold-dipped brass rods suspended over bar and by tall tropical plants which are lighted from below to give additional sparkle to the room. Maitre d's table (right center) is the nerve center from which lights can be dimmed or brightened to provide any dining atmosphere.

*Photo courtesy Superior Electric Co., Bristol, Conn.*





# Recommended Light Characteristics of Acrylic Used in Illumination

**Prepared by the IES-SPI-NEMA Subcommittee of the Light Control and Equipment Design Committee of the Illuminating Engineering Society**

## Foreword

The use of plastic as an important function of light control is widely accepted in the lighting industry. Because of the acceptance and wide use there has been a continual demand for accurate correlation of data on the various plastics as light control media and also data on predicted maintenance and life. Several years ago, the activity of the Light Control and Equipment Design Committee was extended to investigate methods of providing members of the Illuminating Engineering Society with adequate information.

A subcommittee composed of members of the IES, the Society of the Plastics Industry, Inc., and the National Electrical Manufacturers Association was formed. Early studies had determined that the problem was threefold: first, to establish measuring methods and terminology acceptable to both the lighting and plastics industry; second, to recommend light characteristics for various plastics so that correlation of measurable data would be made from materials conforming to basic recommendations; and third, to determine and correlate data applicable to the prediction of the behavior of plastics in lighting luminaires.

The materials first chosen were polystyrene and acrylics. These are to be followed by vinyls and polyethylene. The first report, "Recommended Light Characteristics of Polystyrene Used in Illumination,"* and this second report "Recommended Light Characteristics of Acrylic Used in Illumination," provide recommendations for the lighting industry to provide materials with predictable test results.

The primary responsibility of the IES representatives has been to furnish the leadership in covering the illuminating qualities, while the Society of the Plastics Industry and the National Electrical Manufacturers Association groups developed suitable mechanical and physical characteristics.

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## 1. Scope

These recommendations for light characteristics serve to identify and to characterize thermoplastic acrylic cast sheet and molding compounds for use particularly in the manufacture of fluorescent luminaires. Fabrication factors, luminaire design and performance are considered to be beyond the scope of this recommendation.

## 2. Types

These recommendations cover four types of acrylic compositions:

*Published Illuminating Engineering, Vol. LIII, No. 5, p. 284 (May, 1958).

Approved by the Council of the Illuminating Engineering Society, April, 1960.

Class A—Heat resistant cast sheet.
Class B—Heat resistant molding powder.
Class C—General purpose molding powder.
Class D—Easy flow molding powder.

### 3. General Requirements

To provide a basis for testing and checking lighting performance:

**(a)** The composition should be uniform and so compounded as to conform to the requirements in these recommendations.

**(b)** Samples of colored compositions should be submitted to the user for approval of color and should be representative of subsequent supply.

### 4. Detail Requirements

To insure that the test specimens are representative for checking illumination performance:

**(a)** Molding powder test specimens should be injection molded under conditions recommended by the material supplier.

**(b)** Cast sheet and molding powder specimens should be tested as described in the reference ASTM Standards.

**(c)** All specimens should conform to the requirements of their respective classes in Table I.

### 5. Sampling

**(a)** *Cast Sheet* — Use a 1/8-inch-thick sample when possible. Test specimens should be especially prepared from the material under conditions simulating those of manufacture for any other special thickness.

**(b)** *Molding Powder*—Unless otherwise agreed between supplier and user, the material should be sampled in accordance with the sampling procedure described in the Methods of Testing Molding Powders used in Manufacturing Molded Electrical Insulators (ASTM Designation D392). A batch should be considered as a unit of manufacture as prepared for shipment and may consist of a blend of two or more "production runs" of material.

**TABLE I—Requirements of Test Specimens.**

| | ASTM Test Method* | Class A | Class B | Class C | Class D |
|---|---|---|---|---|---|
| Specific Gravity, min. | {D792 | 1.18 | 1.18 | 1.17 | 1.17 |
| max. | {Method A | 1.20 | 1.20 | 1.19 | 1.19 |
| Tensile Strength, min., psi | D638 | 8000 | 8000 | 8000 | 8000 |
| Elongation in 2 in. min., % | D638 | 2 | 2 | 2 | 1.5 |
| Impact Strength, min., ft.-lbs./inch of notch | D256** | 0.3 | 0.2 | 0.2 | 0.2 |
| Heat Distortion Temperature, min. °F, 1/2- x 1/4- x 5-inch specimen, 264 psi fiber stress | D648 | 185 | 183 | 162 | 149 |
| Burning Rate, in. per min., max. (greater than 0.250 in. sample) | D635 | 1.5 | 1.6 | 1.5 | 1.4 |

*May be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pa.
**ASTM Designation D256, Method C, except that the notch should be produced by a machining operation.

**TABLE II—Recommended Illumination Characteristics.**

| | ASTM Test Method | Class A | Class B | Class C | Class D |
|---|---|---|---|---|---|
| Stability Toward Yellowing (yellowing factor not more than 3), hrs. Fade-O-Meter, min. | {D791 and {par. 6(c) | 500 hrs. | 1000 hrs. | 1000 hrs. | 1000 hrs. |
| Refractive Index (colorless) 23C, at Sodium D, max. | D542 | 1.50 | 1.50 | 1.50 | 1.50 |
| min. | | 1.48 | 1.48 | 1.48 | 1.48 |
| Light Transmittance colorless, min. % up to 0.188 inch | D791 | 91 | 90 | 90 | 90 |
| Variation, max. % (absolute) CIE Illuminant C, colored | D791 | ±5% | ±4% | ±4% | ±4% |

### 6. Recommendations and Test Methods

Recommendations for illumination characteristics are shown in Table II, and the test methods recommended to be used in determining these characteristics follow.

**(a)** *Conditioning*—For those tests where conditioning is required, the test specimens should be conditioned in accordance with Procedure B of the Methods of Conditioning Plastics and Electrical Insulating Materials for Testing (ASTM Designation D618).

**(b)** *Test Conditions*—Tests should be conducted in the standard laboratory atmosphere of 23C±1C (73.4F±2F) and 50±2 per cent relative humidity, unless otherwise specified in the testing methods.

**(c)** *Stability Toward Yellowing*

(1) *Fade-O-Meter (Type FDA-R)* carbon arc accelerated aging device operated in accordance with procedures recommended in ASTM Recommended Practice E42-56T at a black-panel temperature of 120F. Use *Hardy-type spectrophotometer* to determine color change.

(2) *Specimen Preparation*—Specimens of 0.125-inch±0.005-inch thickness should be prepared from material by injection or compression under conditions specified by the material supplier. On cast sheet use as-received material.

(3) *Determination of Yellowing Factor* — After specimens have been exposed for the minimum time required in these recommendations, they should then be measured with the spectrophotometer in accordance with Test for Luminous Reflectance and Color of Materials (ASTM Designation D791). The following equation should be used to calculate the yellowing factor:

$$\text{Yellowing Factor} = 100\,\frac{(T_{420} - T'_{420}) - (T_{680} - T'_{680})}{T_{560}}$$

where $T_{420}$ = per cent transmittance of same thickness of unexposed material at 420 mμ

$T_{560}$ = per cent transmittance of same thickness of unexposed material at 560 mμ

$T_{680}$ = per cent transmittance of same thickness of unexposed material at 680 mμ

$T'_{420}$ = per cent transmittance of specimen at 420 mμ

$T'_{680}$ = per cent transmittance of specimen at 680 mμ

(4) *Tolerable Yellowing* — Specimens tested as above should be considered as objectionably yellow if a yellowing factor of 3 is exceeded.

**(d)** *Refractive Index*—Methods of Test for Index of Refraction of Transparent Organic Plastics (ASTM Designation D542).

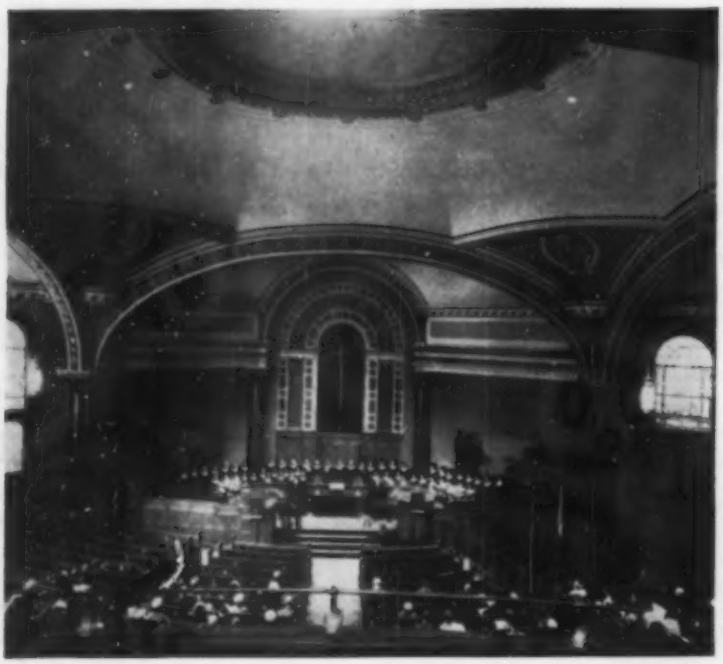
**(e)** *Light Transmittance*—Standard Method of Test for Luminous Reflectance, Transmittance and Color of Materials (ASTM Designation D791), except that the specimen thickness should be 0.125 inch ±0.005 inch.

### 7. Number of Tests

One set of test specimens as prescribed in the methods of testing (Section 6) should be considered sufficient for testing. The average result for the specimens tested should conform to the requirements prescribed in these recommendations. All of the tests listed in Section 6, where applicable to the material, may be used to establish conformity of a material to these recommendations. It is recommended that routine inspection be limited to those tests required to identify the material to the satisfaction of the purchaser.

APPENDIX

*Hiding Power*—Hiding Power is related to the degree of image obscuration. There is no accepted definition or test method for determining this property at this time. However, there is continuous work by IES, ASTM and other technical organizations to develop an acceptable definition and test method.



## Modern Lighting Compliments Traditional Church Design

**Modern lighting design preserving the beauty of the traditional architecture of First Presbyterian Church, Poughkeepsie, N. Y., is a combination of recessed equipment and decorative lanterns. Main lighting is from 18 downlights recessed around the dome and in the transept. Dome units are equipped with 750-watt lamps; transept units with 500-watt lamps. For accent (20 fc) on the pulpit and lectern 100-watt projector lamps were installed in four main downlights.**

**Choir loft is lighted to 20 fc by spots and downlights installed behind an arch. For reading in the main worship area, pinhole units with 100-watt lamps, recessed under the balcony, supply an illumination level of 15 fc. All lighting is on dimmers for variations of mood.**

**Photo and data courtesy of Taylor Barr, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.**



A.I.A. File No. 31-f

INSTALLATION AT CARL SANDBURG JUNIOR HIGH SCHOOL, LEVITTOWN, PA.

# Lighting an Indoor Swimming Pool

**LIGHTING OBJECTIVE:** To light a high school indoor swimming pool for swimmers and spectators.

**GENERAL INFORMATION:** This pool area is 75 feet by 100 feet with a curved ceiling which is 18 feet high at the walls and 27 feet at the center. Colors and reflectances of the major surfaces in the area are:

| | | |
|---|---|---|
| ceiling | gray plaster | 60% RF |
| walls | yellow cinder block | 71% RF |
| floor | yellow tile | 33% RF |
| | gray tile | 23% RF |

**INSTALLATION:** An initial average level of 50 footcandles was provided by 28 Holophane Co., Inc. catalog No. 635-AL luminaires with prismatic glass reflectors and spun-on aluminum covers. Each unit has provisions for a nine per cent upward component of light and is equipped with a 400-watt H1LB improved-color mercury lamp. The units are installed above the ceiling in Plexiglas domes projecting above the roof line, as shown in Fig. 2, on 12-foot by 16-foot 9-inch spacing.

Brightnesses were: ceiling, 4.6 fL; walls, 11.5 fL; floor, yellow tile, 13.5 fL; gray tile, 9.3 fL; and aluminum band on luminaire dome, 14.5 fL.

*(over)*

A.I.A. File No. 31 f

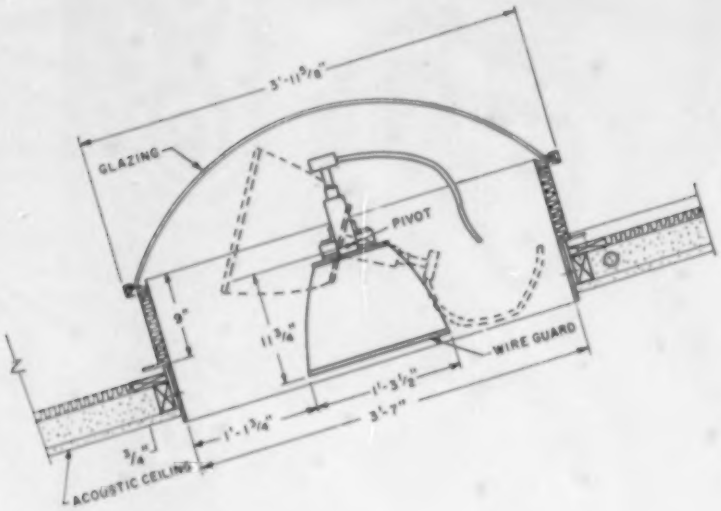



Figure 2. Detail of sky dome.

Luminaire maintenance can be performed from the roof by turning the unit as shown in Fig. 2. During the day the plastic domes admit daylight to provide some general illumination. At night, when the swimming pool is illuminated, the lighted domes provide an interesting effect from the outside.

**Lighting designed by Haag and d'Entremont, Architects, Jenkintown, Pa.; John Knecht, Consulting Engineer, Collingswood, N. J.; Peter Lowenthal, Electrical Contractor, Philadelphia, Pa.**

**Lighting data submitted by Carl Gershanick, District Manager, Holophane Co., Inc., Abington, Pa. and by George T. Anderson, Jr., Philadelphia Electric Co., Philadelphia, Pa., as an illustration of good lighting practice and to aid in the design of similar installations.**

**Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.**

# LIGHTING NEWS

# Nine IES Regional Conferences Reach 1661 People

This is a sort of bird's-eye view of the 1960 Regional Conferences, a post-mortem of all nine meetings. With the conferences scheduled to "tread upon another's heel, so fast did they follow" (*Hamlet*, Act IV, Scene VII), a report this year offers a chance for a broad view of this major IES activity. Bird's-eye-views, of course, miss the hominess of individual reporting—but they do have the advantage of an over-all look at things.

For instance, the 1661 attendance figure, at first glance, seems impressive. After a broader look at what goes into these conferences, the wonder is that the attendance at *each* conference, not all nine together, isn't almost this figure. With varying degrees of success, all of the conferences offered the very type of program that would be most helpful to their jobs for 90 per cent of IES members, and a good many non-members.

For instance, what lighting salesman wouldn't find it helpful to be brought up to date on such subjects as those in the boxed column below? And this does not list the entire program. A great variety of lighting products and practice developments were brought before this year's conference audiences. Lamp developments, of course, but in addition: high frequency lighting; round-up of outdoor lighting; latest in church lighting practice; residential lighting; fluorescent ballast protection; floodlighting; maintenance, to name a few.

On many of the conference programs these talks were billed as the "Technical Session" or the "Technical Program." This could be a misnomer. None was in any sense a technical presentation. They were "shop talk" of the highest order, miniature refresher courses in lighting, opportunities for lighting men to ex-

## Outstanding Conference Subjects

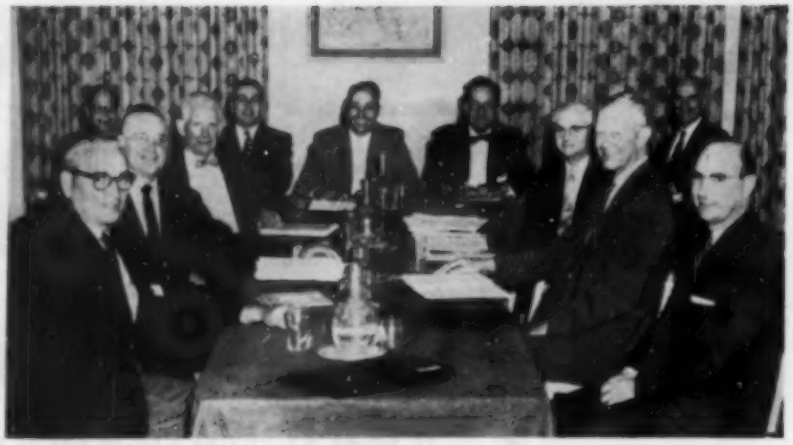
- The Lighting Market Ahead (Gene Pauly, at the Hollywood meeting).
- Lighting Trends in the Sizzling Sixties—at Corpus Christi, by Berlon Cooper.
- Trends in Fixture Design and Application — R. G. Slauer at Northeastern meeting).
- Developments in Dimming Controls—(Joel Rubin, also at Northeastern).
- Which Lamp and Luminaire Where—(John Niedhart, at Intermountain).
- Evaluating Comfort in Higher Footcandle Installations. This included a masterful explanation of the "scissors curve" and other methods of evaluating comfort of a lighting job. By Charles L. Amick at Los Angeles, Phoenix and Sioux City.
- Interpreting Light Distribution Curves—(J. C. Harrison at Halifax) and Report on Discomfort Glare (Willard Allphin also at Halifax).
- Integrated Lighting and Air Conditioning — a hot subject given by experts. Ben Benson at Corpus Christi; Carl Allen at Seattle and Phoenix; C. V. McReynolds at Sioux City; H. L. Cushman in Memphis; N. W. Bethune, in Halifax.
- Comparing Fixture Values (Fred Guth at the Phoenix meeting).
- Lighting Downtown Stores—the trend to city Malls. Everett Folsom discussed it in Corpus Christi, Bob Zahour in Sioux City.
- High Levels in Industrial Lighting—Bob Wylie gave this highly significant talk in both Hollywood and Seattle.
- More New Facts from Research, Since the Blackwell Report—Cash Crouch reporting a subject vital to every lighting man, at several Regional Conferences, starting with Memphis.
- Panels—with audience participation, packed with information valuable to a lighting man in his job. Some of these: Lighting in 1975; An Architect Looks at Lighting (three AIA members on the panel); Lighting-Heating-Cooling; New Concepts in Roadway Lighting.
- One of the best all-day programs ever put on by IES was the joint conference with the AIA and the Great Lakes Regional Conference in Cleveland. Titles of the talks can't begin to describe this, or even give a clue to their value. However:
  - Visual Environment for Greater Productivity (W. H. Johnson).
  - Esthetic Trends (G. W. Clark).
  - Lighting for Form and Function (John Neidhart).
  - Our Mutual Objectives (J. N. Richards—Past-President of AIA).

change the latest information in several phases of the lighting field. For the stimulation alone they provided to those attending, the companies sending their men were well repaid—for those delegates attending the sessions, that is.

Few would agree that each paper was equally stimulating. Some of them could be old hat to many in the audience. But every conference presented one or more outstanding subjects (see boxed list), and several of them had complete programs of highly pertinent discussions. For lighting men eager to "keep up," the IES Regional Conferences would seem to offer one of the best opportunities for doing so.

Applied Lighting Competitions apparently have become a popular item at every Regional Conference. Attendance at this "session" is invariably high. This figures. Most of the entries, especially at the Regional level, are very interesting descriptions of good lighting practice. A few are almost too unusual,

(Continued on page 16A)



**IES COUNCIL Executive Committee scheduled its April meeting concurrent with the Southeastern-South Central Regional Conference in Memphis. Left to right around the table: A. C. Barr, Chairman, Finance Committee; C. L. Crouch, Technical Director; Kirk Reid, Past-President; R. G. Slauer, First Vice-President; J. B. Browder, President; J. R. Chambers, Second Vice-President; G. F. Dean, General Secretary; W. P. Lowell, Jr., Treasurer; J. D. Mitchell, Director. In background, J. M. Gensburger, South Central RVP; at right, A. D. Hinckley, Managing Director.**

**For 1961 Conference File—cut on dotted line**

## Good Ideas—For Conference Planning

Future conference planners may find helpful a wind-up of good ideas from this year's conferences. A collection of these is listed at random below:

- Included in conference packet—a list of interesting buildings and/or lighting installations to see in conference city. Seattle only one to think of this.
- P R & I opportunities—TV appearance of IES President; press interviews with visiting experts; multilithed summaries of conference talks sent to all trade magazines as well as newspapers. Some conference publicity chairmen did this and more—but not all.
- To stimulate pre-conference registration, Great Lakes had a drawing every day (of pre-registered names). Their prize was two tickets to the Yankee-Indian ball game.
- To pay for the coffee break, South Pacific Coast had a raffle (contributed prizes) during each break. The ladies sold the tickets, three chances for a quarter.
- Good display signs, routing delegates to the right room.
- Easels at the door, with title of talk and name of speaker. A variation of this in Hollywood was a black-light blackboard which could be seen even in darkened auditorium.
- Name of speaker, large and clear, suspended from the top of the rostrum.
- Chalkboard, also large and clear, in hallway or auditorium, for numerous conference announcements.
- Decorative lighting techniques to change the dull old hotel ballroom.
- A trend toward very informal buffet parties (with or without dancing), and away from formal banquets.
- Presidential address at a President's Luncheon, not at the party.
- A cocktail party for Sustaining Members, hosted by Section, Region or IES President. Sustaining Members also honored at special table at President's Luncheon.
- Ten-minute talk on IES operation by visiting headquarters' staff.
- Sergeant-At-Arms was a good idea (South Pacific Coast). He was very successful in rounding up members for start of sessions, luncheons and other events. Manned the door, called time on speakers, in general kept everything on schedule.
- One region printed extra tickets for individual technical sessions. These were purchased by local members to give as courtesy-invitation to non-IES architect, contractor, etc. customers.
- In another region, local university students got academic credit for attending technical sessions.
- An "Architects' Day" at Great Lakes was a smashing success. This was joint meeting with local AIA, one full day of the conference. All IES talks were slanted to architects' interests; chief speaker at lunch was local AIA chairman. Architect attendance very high.
- Pre-registration list, all typed up and included in delegate's folder (with his badge and tickets), helps look up friends, customers and hospitality invitation lists.
- Side trips. Like the one to Boeing plant in Seattle, street lighting tour in Los Angeles, Naval installation in Halifax.
- Travel gavels—or other awards for high Section attendance, in per cent of miles traveled.

# What Makes a Good Conference? . . .

## APPLIED LIGHTING COMPETITION

Regional Vice-Presidents at all ten conferences had this happy chore: presentation of check and certificate for first prize in Applied Lighting Competition. This one, from RVP Gensburger to Edna Fortier, in Memphis.

On to Pittsburgh for Gordon Buzan, Vancouver, Class II winner. Prize is presented by RVP Beverly Travis in Seattle.

Great Lakes winner—Bill McCarthy. Prize from President Browder (left).

Photo at left, Canadian winner, Rod Buell (left) gets prize from National ALC Chairman, Carl Wilson. At right, Midwestern Class II winner Burton Benjamin is congratulated by President Browder.

Northeastern ALC contestants, left to right, photo above, Robert Chin, Class II winner; Douglas Worth; O. W. Greenfield; Virginia Skinner; Arnold Robinson; Sylvan Shemitz, Class I winner.

Typical of judges at all contests was this trio of IES Fellows (photo at left)—R. L. Zahour, Carl Allen, Carl Zersen.

# What Makes a Good Conference? . . .

## SPEAKERS

**Panelists were favorite speakers at many IES Regionals. Roadway Lighting panel (left) at South Pacific Coast Conference, Los Angeles, featured, l. to r.: Roy Matthews, George Fairbanks, Oscar Meissner.**

**AIA Past-President, John Noble Richards (photo below, left) was luncheon speaker in Cleveland.**

**Great Lakes Panel on Lighting-Heating-Cooling (below right) with, l. to r.: Murray Quin, W. S. Fisher, R. Franklin Outcalt (Moderator), Realto Cherne.**

**"An Architect Looks at Lighting" panel at Southwestern Regional Conference, Corpus Christi, had (l. to r.) Don Madden, Chairman, Ark-La-Tex Chapter (standing), Joe G. Smyth, C. P. Donnelly and Walter E. Wilde.**

**In brilliant Arizona sunshine speakers and delegates take a break—Intermountain Regional Conference, Phoenix.**

IES President Joe Browder (left) spoke at every Regional Conference.

Photo below, TV interviewers, at far left and right, query J. B. Browder (left center) and Dr. Clarence Larry, one of the speakers at the Pacific Northwest Conference in Seattle.

One of the most stimulating sessions was by this group of speakers (at Great Lakes) on Esthetic and Environmental Trends. Left to right: John Neidhart, William Johnson, William Kahler, Joseph Morbito (session chairman) and George Clark.

His Worship, Mayor Charles Vaughan of Halifax, was guest luncheon speaker at the Canadian Regional Conference hosted by the Bluenose Chapter.

Hi-jinks sugar-coat the educational pill when Alston Rodgers with his "Uke-lightly" is the speaker.

Ed Ramsbusch, popular speaker at more than half of this year's conferences.

# What Makes a Good Conference? . . .

## PEOPLE

Cooperation and friendship, a prevailing spirit at IES Regional Conferences. At left, President Browder accepts Nova Scotia flag from Hon. Stephen Pyke; left, J. R. Chambers, right, John Chorlton, Canadian RVP. In photo at right, the Browders landing at the Phoenix airport are greeted by Intermountain Chairman, Don Ruff.

Registration for all ten Conferences was 1661. Signing up for Northeastern, R. G. Slauer, President-Elect. Committeemen, J. F. Flanagan, P. M. Crosby.

W. Stew Buckler (right) came all the way from Winnipeg to Halifax for the Canadian Regional Conference. In photo at left, he receives ALC Second Prize from National ALC Chairman Carl Wilson. Pictured in photo at right, some former Pacific Northwest RVP's—Walter Lind, Ken Hollingsworth, Eric Ackland.

"Teams" representing many others across U.S. and Canada. L. to r., with teammates in front: C. E. Ellis (IES Headquarters), R. L. Zahour, L. A. Bean, J. B. Browder, C. M. Holden, R. L. Smart, R. G. Slauer, G. J. Taylor.

Each Region had its distinguished elder statesmen. Great Lakes (above) had three Past-Presidents, honored at a special table. From left: Dr. Ward Harrison, the Kirk Reids, the R. F. Hartensteins, Mrs. Harrison.

Past Presidents with President Browder (left) at Northeastern Conference—left to right, Julius Daniels, R. B. Brown, Jr., George J. Taylor.

Sustaining Members—Very Important People. Two special tables for them at Regional Conference in Cleveland.

At South Pacific Coast (Los Angeles) l to r., photo at right: Charley Amick, Foster Sampson, Cash Crouch, Robby Robinson.

People by the score attended technical sessions (photo below) such as this one in Memphis.

# What Makes a Good Conference? . . .

## FUN

**Receptions—this one in Memphis (photo at left) shows J. B. Browder, H. Q. Pray (partially obscured), Mrs. Browder, G. J. Segal (New Orleans Chairman), Mrs. Goodman, Louis N. Goodman, Murray Reiter, Jacob M. Gensburger, South Central RVP.**

**To the Valley of the Sun for some of the 48 ladies (photo above) attending the Intermountain Regional Conference.**

**Lobster Picnics—Halifax, left; Wentworth-by-the-Sea, right.**

**Las Vegas Night—in New England. Gamblers are Past-President George Taylor, President-Elect Dick Slauer, President Joe Browder, John McDougall, New Jersey Chairman, Hank Clum. Dealer is J. J. Reddington.**

**Hi-Frequency Corral—local IES entertainers (with lighted beanies) at Pacific Northwest Regional were (not necessarily in this order) Jack Cottingham, Harry Olson, Antony Jones, Don Frost, Ray Rookey.**

# What Makes a Good Conference? . . .
# COMMITTEES

Some idea of the number of people involved in planning a successful IES year, including Conference, is shown in this picture of the Regional Activities Meeting for Northeastern Regional. RVP Ray Smart (center front) presides.

Conference Committee for Sioux City (Midwestern) Conference takes a bow.

Pacific Northwest Conference Committee (Seattle) at the end of it all.

Bill Shalda, left in photo at left, headed Los Angeles Conference with Ben Hartmann, right, Southern California Section Chairman. They are shown here with President Joe Browder.

Two chairmen (photo at left, below) ran Midwestern Conference: Mark Lee (left) and C. R. Tracy (far right). Brooks Chassaing, RVP, looks on.

Far into the night—RAC meeting, Pacific Northwest Region (below, right). Presiding was RVP Bev Travis (head of table, right) and incoming RVP Jack Cottingham (left).

## 1960 IES Regional Conferences

| Region | Place | Date | Attendance | Chairman |
|---|---|---|---|---|
| South Central and Southeastern | Memphis, Tenn. | April 21-22 | 126 | J. F. Fletcher |
| Southwestern | Corpus Christi, Texas | April 24-26 | 200 | B. L. Guess, Jr. |
| Inter-Mountain | Mountain Shadows, Ariz. | April 27-29 | 173 | D. L. Ruff |
| South Pacific Coast | Hollywood, Calif. | May 3-5 | 135 | William Shalda |
| Pacific Northwest | Seattle, Wash. | May 9-11 | 225 | G. Don King |
| Midwestern | Sioux City, Iowa | May 12-13 | 212 | Mark E. Lee and C. R. Tracy |
| Great Lakes | Cleveland, Ohio | May 16-17 | 251 | R. D. Churchill |
| Northeastern | Portsmouth, N. H. | June 8-9 | 133 | C. M. Holden |
| Canadian | Halifax, Nova Scotia | June 12-14 | 206 | H. Lushington |
| | | Total | 1661 | |

## ALC Regional Winners—1960

| Region | Class I (Residential) | Class II (Commercial) |
|---|---|---|
| Canadian | | R. E. Buell<br>Bluenose Chapter<br>"Shopping Center Restaurant Lighting" |
| East Central | (No Conference. Contest to be held in September.) | |
| Great Lakes | Alfred Makulec<br>Cleveland Section<br>"High Footcandle Structural Lighting in a Residence" | William J. McCarthy<br>Western New York Section<br>"Lighting the Amherst Lanes" |
| Inter-Mountain | M. W. Downey & W. G. Perram, Jr.<br>Arizona Section<br>"Dr. & Mrs. Monroe Shack's Residence" | Arnel G. Anderson<br>Arizona Section<br>"Guggy's Tower Plaza Restaurant" |
| Midwestern | John D. Hilburn, Jr.<br>Heart of America Section<br>"Contemporary & Unusual" | Burton Benjamin<br>Chicago Section<br>"Museum of Science and Industry Floodlighting" |
| Northeastern | Sylvan R. Shemitz<br>Connecticut Section<br>"A Living Laboratory for Light for Living" | Robert Chin<br>New England Section<br>"Control Room Lighting—Robert Moses Power Dam, St. Lawrence Project" |
| Pacific Northwest | J. T. Cottingham<br>Oregon Section<br>"How to Live Happily—With Lighting" | Gordon F. Buzan<br>British Columbia Section<br>"Lighting a Maritime Museum" |
| South Central | Mrs. Edna P. Fortier<br>New Orleans Section<br>"Luxury Residential Lighting" | Louis N. Goodman<br>New Orleans Section<br>"Lighting Main Concourse, Moisant International Airport, New Orleans" |
| Southeastern | Miss Ruth Morris<br>Georgia Section<br>"Relighting Cottage—Rock Eagle 4-H Club Center" | Barney P. Best<br>Florida Section<br>"Anhauser-Busch Hospitality House" |
| South Pacific Coast | Robert Haskell<br>Golden Gate Section<br>"New Lamps for Old" | Bruce Thyberg<br>San Diego Section |
| Southwestern Region | Mrs. Maxine Briggs<br>Central Oklahoma Chapter<br>"Gold Medallion Home" | Dana Price<br>San Jacinto Section<br>"St. Therese Church" |

(Continued from page 8A)

but almost all are interesting solutions to lighting problems often encountered, and it would be a rare occasion that one didn't get several good ideas from them. What better shop talk is there than how one man solved a problem—with pictures to illustrate it? This program has also been a natural for bringing to the spotlight architects, consulting engineers and/or lighting practitioners—people *applying* IES principles—who might otherwise never be heard. The program has enriched people on both sides of the podium.

Results of this year's IES Applied Lighting Contest are shown on this page. All those listed, for both classes, go on to Pittsburgh for further competition.

Although conference planning committees all follow the same "Guide to IES Regional Conferences," it is interesting to experience the entirely different flavor peculiar to each conference. Sections which have been host many times to IES meetings develop a know-how that practically guarantees a high-level conference. Newer chapters venturing their first big meeting may under-estimate the size of the job, but on the other hand often come up with some refreshing innovations. For a list of successful practices from all of this year's conferences, see page 8A.

Resorts *vs* cities is often debated for both national and regional conferences. Which makes for the most successful meeting? It depends on the approach of the planning committee and what is considered "success" by most of the people within the Region. It can happen—and did at one of this year's conferences—that weather and environment conspire against session attendance; too beautiful. Probably the ideal situation would make it easy to go to the sessions, let no other program conflict with this, and then live it up after hours.

(Continued on page 21A)

# ABOVE ALL:

## Styrene lighting fixtures molded of LUSTREX® PERMA TONE

Lighting fixtures in Shaw's Pharmacy, Allentown, Pa., manufactured by The Miller Company, Illuminating Division, Meriden, Conn. Enclosures extruded by Custom Extrusion, Inc., Sheffield, Mass.

More Lustrex perma tone is used for lighting fixtures than any other ultraviolet light-stabilized styrene.

In clear white and a complete color range, it falls within IES-NEMA-SPI joint specifications for ultraviolet light-stabilized styrene. With perma tone you can create low cost large areas of illumination with good diffusion, dimensional stability, and uniform light distribution.

New Impact Lustrex perma tone provides extra toughness and flexibility for snap-fitting to metal parts, high resistance to abnormal abuse, lighter weight through thinner walls. For free technical report on both regular and impact Lustrex perma tone styrene, including accelerated aging test results and other valuable data on styrene in lighting fixtures, write to Monsanto Chemical Company, Plastics Division, Room 788, Springfield 2, Massachusetts.

LUSTREX: Reg. U.S. Pat. Off.

Monsanto

**MONSANTO** ORIGINATOR IN **PLASTICS**

***the latest lighting advancement from...***

# APPLETON®
*electric company*

# first

**lighting unit to give you top operating performance from the amazing Quartzline lamp!**

## *Intenso.* "QUARTZLITE 500"

Only the Appleton *Intenso* "Quartzlite 500" is precision engineered to meet the lamp manufacturer's efficiency and operating standards for the new 500-watt, filament type, iodine cycle lamp.

Its new, compact design was specially developed for this powerful lamp to give you 19% greater, *constant* light output of 21 lumens per watt... and twice the average life of a conventional 500-watt lamp.

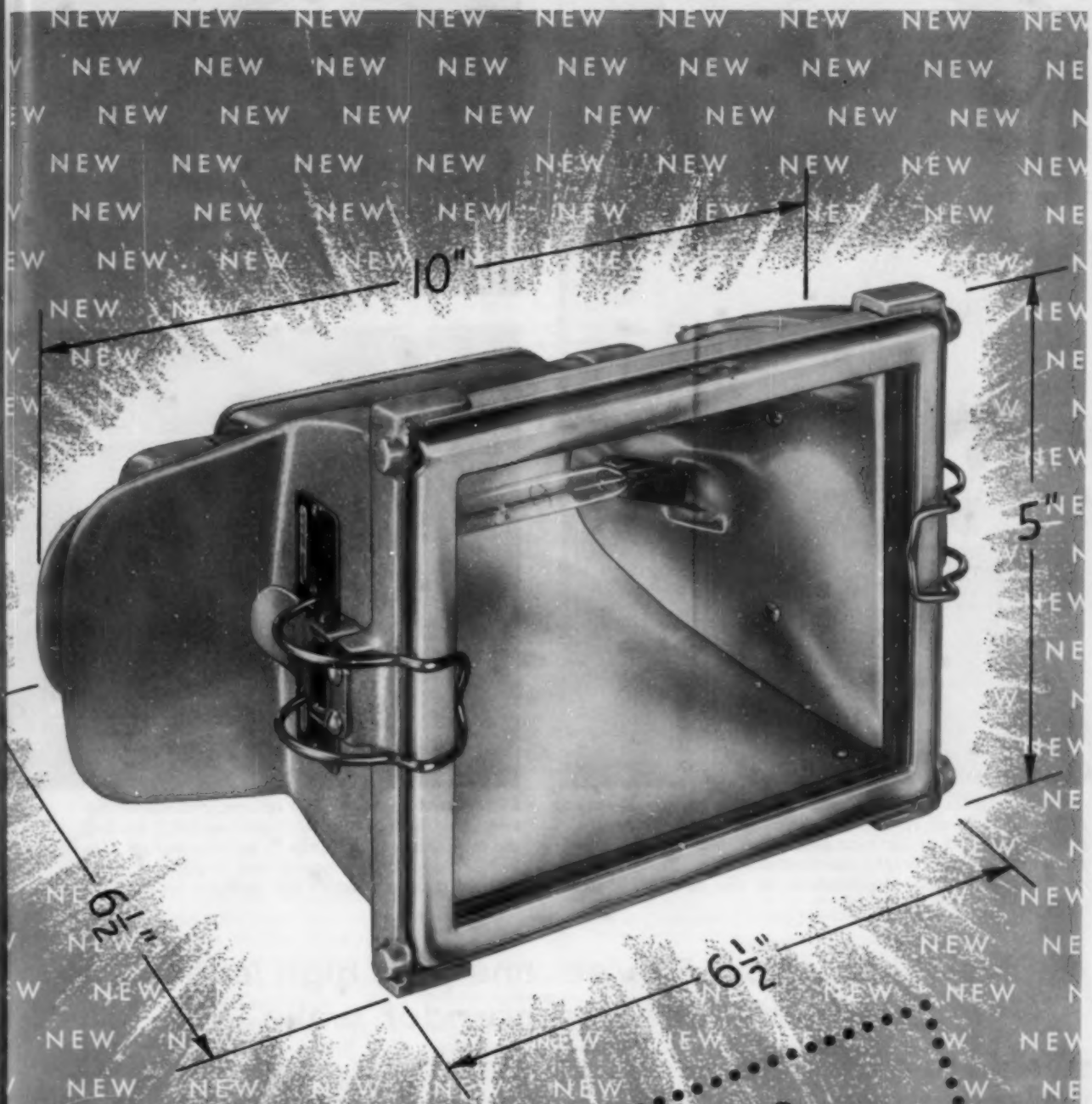
That's not all! For the first time, attractive lighting installations can be made in very small space areas — easily, economically. The special weatherproof unit design also puts light where you want it. Its extremely sharp cutoff—in a rectangular beam spread—eliminates the usual need for beam overlap, yet provides adequate, uniform light for innumerable applications indoors and out.

For increased lighting efficiency in Industry • Business • Recreation • Transportation, buy or specify the versatile *Intenso* "Quartzlite 500"... ideal for signboards, displays, outdoor sports, building security, mobile equipment, storage areas and many other uses.

WRITE TODAY FOR COMPLETE DETAILS

*Sold through franchised distributors only*

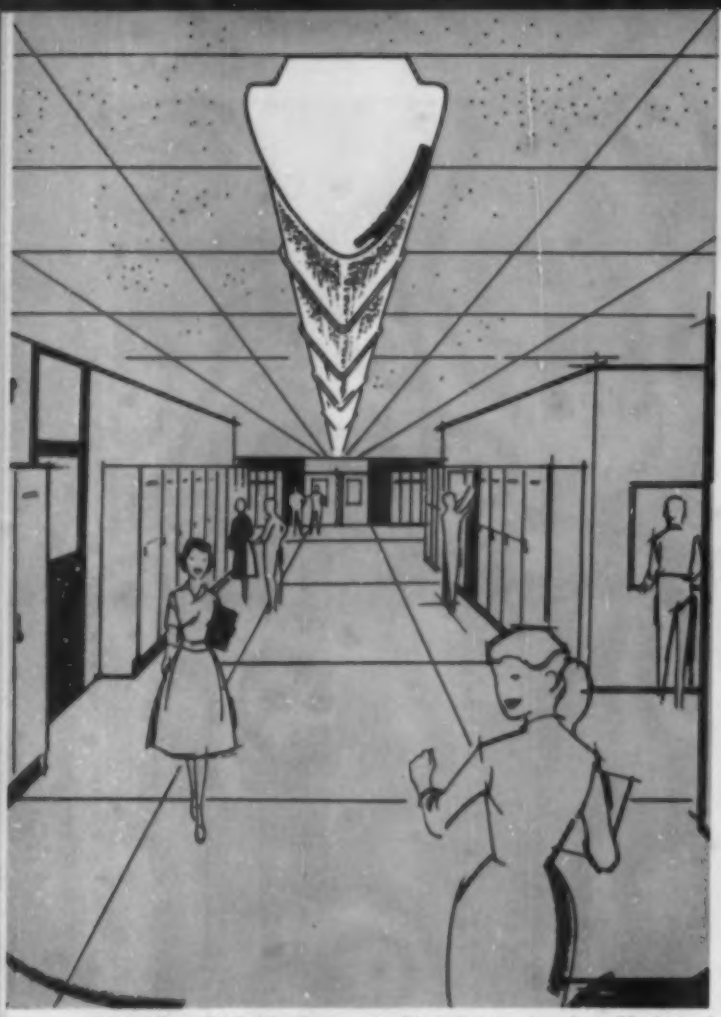
**APPLETON.**
*electric company*
*1701 Wellington Avenue, Chicago 13, Illinois*



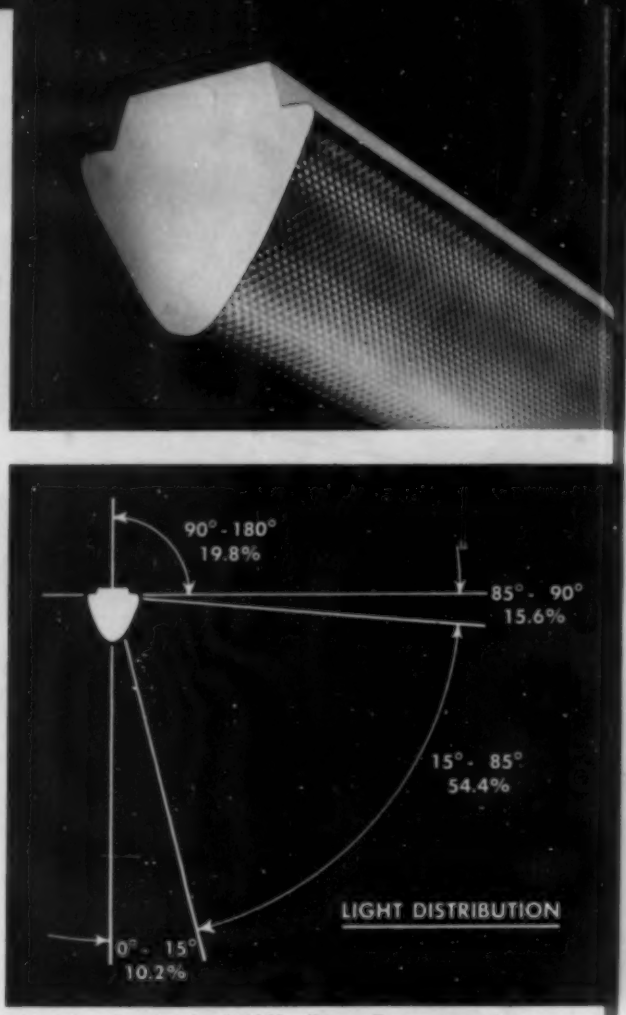

Intenso

"QUARTZLITE 500"

PAT. APPLIED FOR



*Attractive LPI VeeLens corridor luminaire has V-shaped prismatic diffuser and convex reflector which concentrates greatest amount of light on wall areas. Viewed endwise, it provides excellent brightness control—maximum brightness does not exceed 350 footlamberts in the 45° to 90° zone.*




*Light distribution for LPI VeeLens. Percentage figures show amount of light (based on 100% for half the luminaire) which falls in various sectors. Upward component permits proper brightness ratios and relieves contrast on the corridor ceiling.*

# New, low-cost LPI VeeLens puts high levels of useful light on corridor walls

The VeeLens fluorescent corridor luminaire is engineered for efficient application to school corridors, library stacks, stock room aisles, and pedestrian tunnels. It solves the two important corridor lighting problems at lowest possible cost: (1) most of the useful light is directed where you want it—on the vertical surfaces, and (2) brightness down the corridor is controlled to a comfortable level without glare.

Formerly, only far more expensive fluorescent luminaires with intricate shielding, or incandescent luminaires with special lenses directed the useful light so effectively. Now, LPI's VeeLens does the job better at lower cost because it utilizes a clear prismatic diffuser containing thousands of 8-sided prisms. This diffuser combined with the unit's convex reflector distributes useful illumination in the pattern most desirable for corridor lighting—the "butterfly curve." The result is a high level of illumination on the vertical surfaces with controlled brightness when viewing parallel to the luminaire.

VeeLens luminaires are available for surface or pendant mounting, individually or in continuous rows. They utilize one 48" rapid-start lamp in a 4-ft. luminaire, or two 48" rapid-start lamps, tandem, in an 8-ft. luminaire. Diffusers hinge from either side.

*For complete information, write for VeeLens bulletin*

**LPI** FLUORESCENT LIGHTING

**Lighting Products Inc., Highland Park, Illinois**

(*Continued from page* 16A)

Often one of the most talented men on a conference committee is the man in charge of entertainment. If fun and frolic and/or contacts are major reasons for going, many IES conferences fill this bill very well. In this connection, there seems to be a trend to less formal entertainment. Outings, excursions and more closely-knit group activity seem to be taking precedence over formal banquets. Contacts and intra-Society friendships seem to flourish, encouraged by these informal circumstances.

At all of the Regional Conferences the IES President, Joseph B. Browder, was a principal speaker. His provocative message will no doubt be outlined further in his Presidential Address, to be published in next month's IE. Watch for it.

## Lighting Course Required for N. C. Home Economics Students

Beginning in the 1960-1961 fall semester, all home economics students at the Woman's College of the University of North Carolina, Greensboro, N. C., will be required to take a course in lighting and wiring design. The announcement of the course follows the recent installation of a lighting and wiring laboratory at the College, the first such laboratory to be established at a home economics school.

The course, which has been developed under the leadership of Dean Naomi Albanese, will cover electricity in the home, electrical parts and home wiring, physics of light, light and vision, standards and nomenclature, measurement of light, color and reflectances, light control, daylighting, light sources, calculations, interior lighting design for homes, offices and schools and the economics of lighting.

Basic texts to be used in the course include the *IES Lighting Handbook*, Third Edition, *How to Decorate and Light Your Home*, *New Horizons in Color*, *Color and Its Application*, *Residential Wiring Handbook*, *Residential Lighting* and current booklets published by IES, the Better Light Better Sight Bureau, National Adequate Wiring Bureau and many other organizations.

## Consumer Electrical Show Planned at New York Coliseum

Electra City, USA, an eight-day show of electrical appliances for the consumer, has been scheduled to take place at the New York City Coliseum from September 10 to 18. Organized around the theme of "Try Before You Buy," the show will feature an Electric Epicure Kitchen hosted by noted cooking expert, Poppy

(*Continued on page* 22A)

# SCHEDULED EVENTS

**August 22-24, 1960**—National Association of Lighting Maintenance Contractors, Annual Convention, Milwaukee Inn, Milwaukee, Wis. All meetings are open to public.

**September 6-16, 1960**—Production Engineering Show, Navy Pier, Chicago, Ill.

**September 10-18, 1960**—Electrical Living Show, New York Coliseum, New York, N. Y.

**September 11-16, 1960**—Illuminating Engineering Society, National Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa.

**September 21-23, 1960**—American Society of Mechanical Engineers—American Institute of Electrical Engineers, Power Conference, Bellevue-Stratford, Philadelphia, Pa.

**September 28-30, 1960**—Canadian Electrical Manufacturers Association, Sheraton-Brock Hotel, Niagara Falls, Ont.

**October, 1960**—American Society for Engineering Education, Annual Meeting of North-Midwest Section, Marquette University, Milwaukee, Wis.

**October 5-7, 1960**—International Association of Electrical Leagues, Annual Meeting, President Hotel, Kansas City, Mo.

**October 9-14, 1960**—American Institute of Electrical Engineers, Fall General Meeting, Chicago, Ill.

**October 13-15, 1960**—Optical Society of America Meeting, Somerset Hotel, Boston, Mass.

**October 15-20, 1960**—American Institute of Electrical Engineers, Fall General Meeting, Detroit, Mich.

**October 16-18, 1960**—United States National Committee, CIE, Annual Meeting, State College, Pa.

**October 16-22, 1960**—Society of Motion Picture and Television Engineers, Semi-Annual Convention, Sheraton Park Hotel, Washington, D. C.

**October 19, 1960**—Society of Plastics Engineers, Tooling for the Plastics Industry, New York, N. Y.

**October 23-27, 1960**—National Electrical Contractors Association, Las Vegas, Nevada.

**October 25-27, 1960**—American Standards Association, National Conference on Standards, Sheraton-Atlantic Hotel, New York, N. Y.

**November 14-18, 1960**—National Electrical Manufacturers Association (Annual Meeting), Traymore Hotel, Atlantic City, N. J.

**November 17-19, 1960**—Canadian Electrical Association, Engineering Sections, Western Zone, Saskatchewan Hotel, Regina, Sask.

**November 21-23, 1960**—Canadian Electrical Association, General and Sales Sections, Western Zone, Palliser Hotel, Calgary, Alta.

**November 27-December 2, 1960**—American Society of Mechanical Engineers, Annual Meeting, Statler-Hilton Hotel, New York, N. Y.

**November 29, 1960**—American Institute of Consulting Engineers, Annual Dinner, Waldorf-Astoria Hotel, New York, N. Y.

**December 5-9, 1960**—National Conference on Application of Electrical Insulation, Conrad Hilton Hotel, Chicago, Ill.

**January 23-26, 1961**—Plant Maintenance and Engineering Show, International Amphitheatre, Chicago, Ill.

**January 24-27, 1961**—Society of Plastics Engineers, Inc., 17th Annual Technical Conference, Shoreham and Park Sheraton Hotels, Washington, D. C.

**February 13-16, 1961**—American Society of Heating, Refrigerating and Air Conditioning Engineers, Semi-Annual Meeting, Conrad Hilton Hotel, Chicago, Ill.

**February 26-March 1, 1961**—American Institute of Chemical Engineers, National Meeting, Roosevelt Hotel, New Orleans, La.

**March 2-4, 1961**—Optical Society of America, Roosevelt Hotel, Pittsburgh, Pa.

**April 4-6, 1961**—St. Louis Board of Trade, Progress in Electrical-Electronic Equipment Exhibit, Exposition Hall, St. Louis, Mo.

**April 5-7, 1961**—American Institute of Electrical Engineers, Southeast Meeting, New Orleans, La.

**April 10-11, 1961**—Society of Naval Architects and Marine Engineers, Spring Meeting, San Francisco, Calif.

**April 10-14, 1961**—American Society of Civil Engineers, Phoenix Convention, Hotel Westward Ho, Phoenix, Ariz.

**April 20-21, 1961**—Society of the Plastics Industry, Western Section Conference, del Coronado Hotel, Coronado, Calif.

**April 30-May 4, 1961**—Electrochemical Society Meeting, Claypool Hotel, Indianapolis, Ind.

## I. E. S. National Technical Conferences

1960—September 11-16—Penn Sheraton Hotel, Pittsburgh, Pennsylvania

1961—September 24-29—Chase Park Plaza Hotel, St. Louis, Missouri

1962—September 9-14—Statler-Hilton Hotel, Dallas, Texas

1963—September 8-13—Sheraton-Cadillac Hotel, Detroit, Michigan

1964—August 30-September 3—Fontainbleau Hotel, Miami Beach, Florida

**WINNERS in the Allied Arts Competition sponsored by the N. Y. Section, shown here at "Award Night," were, left to right: Charles J. Spiess, III, co-winner, third prize; Luellan Fields, first; Samuel De Sante, co-winner, second prize; Mrs. C. Herskowitz, co-winner, third; William Plyer, co-winner, second. Miss Fields is a Columbia University student, all other winners attend Pratt Institute.**

**In photo at right, some of the speakers at the award ceremonies: William Pahlman (at mike), industrial and interior designer; (seated, to Mr. Pahlmann's left) John Plantinga, Meyer, Strong & Jones, engineers; Robert Jacobs, Kahn & Jacobs, architects. At far right is Joel E. Rubin, chairman of Section's Allied Arts Committee; partially hidden is Section Chairman, William H. Keen.**

*(Continued from page 21A)*

Cannon, an International Kitchen with cooking from all nations, an Electric Clinic sponsored by the Electrical League of New York and a special booth manned by representatives of the Girls' Clubs of America.

Special attractions will include an antique appliance museum, homemaking and cooking contests, sound movies and lectures on homemaking.

According to Harold R. Meyer, producer of the show, 50,000 discount tickets have already been sold to manufacturers and distributors for distribution to consumers and special ticket plans for women's clubs and commuters are currently being implemented.

## 10 Per Cent Decline Reported in Public Utility Financing

According to statistics compiled by the Financial Consulting Service of Ebasco Services, Inc., public utility financing declined by 10.1 per cent in the first half of 1960, $1,673,792,000 against $1,863,628,000 for the first half of 1959. Electric utility financing decreased by $260 million, gas utility financing by $114 million, with telephone utility financing rising by $160 million over the first half of the previous year.

By types of securities, utility debt financing increased by $40 million as compared with the first half of last year, preferred stock decreased $75 million and common stock issued declined by $190 million.

Another significant point revealed in the study was that virtually all utility financing (99.5 per cent) represented new money, with refundings totalling only $8 million. This is interpreted as a reflection of the continued growth and construction in the public utility industry and of the relatively stable interest rates which prevailed during the period.

## New York Section Sponsors Allied Arts Night

Over 150 members and guests of the New York Section attended a dinner meeting devoted to the 18th annual student architectural lighting competition. Program for the meeting featured presentation of awards to winners and a discussion of lighting in relation to architecture and interior design.

The contest problem, architectural and lighting design for an air line ticket office in a large city, drew more than 100 entries from architecture students at Columbia University, Pratt Institute and Cooper Union.

Serving as contest judges and guest speakers at the dinner meeting preceeding the award ceremonies were Robert Jacobs, Kahn & Jacobs, architects; William Pahlmann, William Pahlmann Associates, interior and industrial designers and John Plantigna, Meyer, Strong & Jones, engineers.

Award certificates and cash prizes were presented in two categories—outstanding entry from each school and three Grand Awards. Winners were:

*Grand Awards*—Luellan Fields, Columbia University, first; Samuel De Sante and William Plyer, Pratt Institute, second; Charles J. Spiess III and Mrs. C. Herskowitz, Pratt Institute, third. Owen Brown, Pratt Institute, was awarded Honorable Mention.

*Columbia University Award* — Luellan Fields; *Cooper Union Award* — Joyce Hedman; *Pratt Institute Award*—John Crosby and George Large.

In addition, 18 semi-finalists received copies of the *IES Lighting Handbook*.

Winning designs were exhibited at the IES Northeastern Regional Conference at Wentworth-by-the-Sea, Portsmouth, N. H., and will be on display during the IES National Technical Conference in Pittsburgh, September 11-16.

Joel E. Rubin, Kliegl Brothers Lighting, was chairman of the Section's Allied Arts Committee; Alex Sitkin, Jaros, Baum and Bolles was vice-chairman and H. E. D'Andrade, General Electric Co., served as associate.

## Obituary

**Willis A. Pennow,** well-known aviation lighting authority and Fellow of IES, died on July 1, 1960 at the Lakewood Hospital in Cleveland, following a heart attack. He was 59 years old.

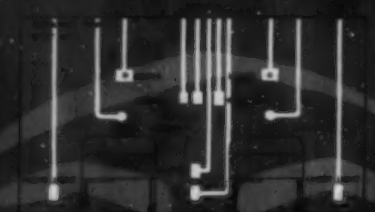
Mr. Pennow's long career in aircraft and navigational lighting was marked by numerous inventions (he held 19 patents), technical papers and awards. His achievements included the development of airport runway lights which became standard U. S. Air Force equipment; an optical system of primary reflector, secondary reflector and tandem shields, standard on all Marine searchlights and the differential arc control system which is standard on Navy searchlights. A modification of his Krypton condenser discharge light for all weather airport approach systems was credited with having contributed substantially to the success of the Berlin Airlift.

A graduate of the Milwaukee School of Engineering, Mr. Pennow also received degrees from the University of Wisconsin and Yale University. During his 30-year

*(Continued on page 24A)*

# Centron-10 means a pleas[illegible] environment

**In one [illegible] system, Centron-10 [illegible]ates up to ten [illegible] bedroom services normally installed separately. This means more comfort to the patient and more convenience to the hospital staff.**



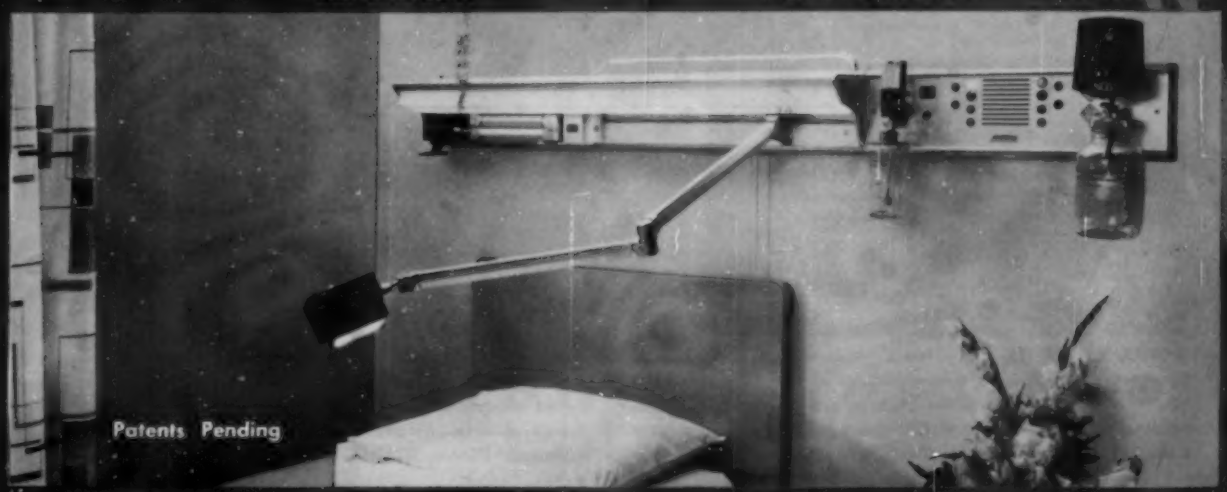
"OLDWAY" — Up to 22 service outlets clutter the walls of two adjoining rooms. Various fixtures and accessory equipment must then be separately ordered and installed.

"CENTRON-10 WAY" — Requires only 8 service lines for back-to-back installation. All auxiliary equipment may be consolidated into the one neat console. No separate fixtures need be ordered.

Centron-10

With Centron-10, hospital bedrooms can be bright, cheerful and almost home-like which may reduce the patients' anxieties and hasten his recuperation. For pleasant general illumination, Centron-10 features a fully enclosed, plastic shielded indirect lighting component. The narrow beam reading lamp adjusts to any convenient and normal reading position. A high intensity, color-corrected exam light on an extendable arm remains in whatever position the doctor chooses. The integral night light is usefully located. Centron-10 also provides for 2-way nurse call systems,* oxygen and vacuum systems,** phone outlets, TV lead-ins and convenience outlets. An intravenous apparatus support which swivels out of the way when not in use is also available.

*Such as Executone **Such as N.C.G.



Patents Pending

**SUNBEAM LIGHTING COMPANY**

[illegible] Los Angeles 58, Calif.
[illegible] Georgia Street, Gary, Indiana

(Continued from page 22A)

career with Westinghouse Electric Corp., he served as a section design engineer, section manager and advisory engineer, the position he held at the time of his death.

For his outstanding work in defense aviation lighting, Mr. Pennow was honored with a Presidential Citation from President Harry S Truman. He also received the Westinghouse Order of Merit and an award from United Air Lines.

For many years, he served on the IES Aviation Lighting Committee, Subcommittees on Approach Lighting and Airport Lighting, and Searchlight Committee. From 1953 to 1955 he was chairman of the Subcommittee on Visibility of Light Sources.

In 1955, Mr. Pennow was honored by the Society with election to the grade of Fellow.

## ABOUT PEOPLE

**James F. Whitehead, Jr.,** was elected president of Day-Brite Lighting, Inc., on June 30, when the company formally became a subsidiary of Emerson Electric Manufacturing Co. of St. Louis. The joining of the companies, involving an exchange of Emerson common stock for the Day-Brite assets, had previously been approved by both firms. Mr. Whitehead, executive vice-president of Day-Brite since 1956, succeeded **O. W. Klingsick** in the position of president. Mr. Klingsick became vice-chairman of the Day-Brite board of directors, with **D. J. Biller** continuing as chairman of the board. Another Day-Brite announcement concerned the appointment of **Joe W. Hale** as representative in the Houston, Texas area. Mr. Hale, who succeeds the recently-retired **N. O. Reed,** was formerly district lamp and lighting specialist for the General Electric Supply Co. in Houston.

The Board of Directors of the American Institute of Electrical Engineers has elected 19 AIEE members to the grade of Fellow for outstanding contributions to the profession. Those elected are: **Marvin A. Baker,** General Electric Co., Erie, Pa.; **F. M. Clark,** General Electric Co., Schenectady, N. Y.; **W. J. Creamer,** University of Maine, Orono, Me.; **Walter Criley,** Vanderbilt University, Nashville, Tenn.; **H. H. Davenport,** Southwestern Bell Telephone Co., Little Rock, Ark.; **H. F. Gidlund,** Public Service Co. of Colorado, Denver, Colo.; **G. W. Heumann,** General Electric Co., Schenectady, N. Y.; **R. D. Jones,** General Electric Co., Fort Wayne, Ind.; **J. Harold Karr,** Robbins & Myers, Inc., Springfield, Ohio; **Marvin Lee,** Burndy Corp., Norwalk, Conn.; **S. B. Lent,** Metropolitan Transit Authority, Boston, Mass.; **M. R. Lory,** Westinghouse Electric Corp., East Pittsburgh, Pa.; **F. W. McCloska,** Sargent & Lundy, Engineers, Chicago; **H. J. Nevitt,** Ericsson Telephone Sales Corp., Rio de Janeiro, Brazil; **J. W. Picking,** Reliance Electric & Engineering Co., Cleveland; **I. E. Ross,** General Electric Co., Fort Wayne; **C. F. Schwan,** Reliance Electric & Engineering Co., Cleveland; **G. G. Somerville,** General Electric Co., Pittsfield, Mass. and **C. R. Vail,** Duke University, Durham, N. C.

McGraw Edison Co., Chicago, has announced the acquisition of the Alrectic Division of the Handley-Brown Co. of Jackson, Mich. The acquisition was effective June 30. **Harold Handley,** former president of Handley-Brown, will serve as president and general manager of the Alrectic Division of McGraw Edison. Alrectic manufactures prefabricated substation structures employing aluminum extrusions designed and developed for the purpose, lattice poles for high-voltage electric distribution and transmission systems and an octagonal street lighting standard.

**Frederick C. Sutro, Jr.,** immediate past-president of the Society of Plastics Engineers, has been named to the chairmanship of the SPE Public Relations Committee by Society president, **George W. Martin.** The appointment carries with it the responsibility for establishing policy and planning public-relations activities on a long-range basis.

Several new assignments have been announced by Sylvania Lighting Products in connection with the company's Salem, Mass. headquarters. Appointments include: **Harold L. Barnum,** product manager—mercury, consumer products, quartz lamps and indicator lamps; **Leslie E. Innis,** product manager — incandescent and fluorescent lamps; **Thomas H. Cashin,** marketing manager—large lamp products; **Chalmer J. Carothers,** sales manager—industrial-commercial lamps; **Alan H. Foster,** division manager of marketing cost control. Also announced was the appointment of **Lawrence P. Pleasants** as sales manager of the Cleve-

(Continued on page 29A)

**WELCOME HOME party for President and Mrs. Joe B. Browder after their two-month tour of the IES Regional Conferences was one of the high points of a gala Georgia Section meeting. Also on the program was the presentation, by Mr. Browder, of Past-Chairman Pins to former officers of the Section. In photo at right, presentation is being made to Jimmie Whitehead (standing, left), oldest past chairman in terms of year of office. In the foreground, left to right: Jack Burns, Section vice-chairman; Mrs. J. Dixon Mitchell and Mr. Mitchell, IES Director.**

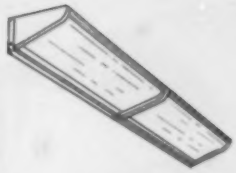
# Revere Outdoor Lighting Report

Revere ELECTRIC MFG. CO.

## Lighting a store front

**The Problem:** To draw attention to a store front and make it look inviting to shoppers by providing high level, uniform lighting for the wall and sidewalk area.

**The Answer:** Revere 9605 Fluorescent Luminaires were installed to give the high level of illumination desired. Eight-foot units were joined to form a continuous, attractive light source that makes the store look inviting. Each 8-foot unit contains two Very High Output lamps and has two 4-foot doors for fast, easy cleaning and maintenance.



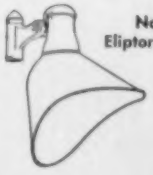
No. 9605
Fluorescent Luminaire

## Lighting a race track

**The Problem:** To illuminate a race track for better visibility, and to provide especially high intensity lighting for dramatic effect at the finish line.

**The Answer:** Revere Eliptor Floodlights mounted on Revere Hinged Poles No. 199-D-30 were installed along the track. In the grandstand area, floodlights were aimed toward the finish line to heighten the intensity. Revere No. 2000 Series long range floodlights were mounted on the grandstand roof to further illuminate this area.

No. 2000 Series
Floodlight

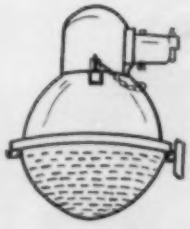


No. 3803
Eliptor Floodlight

## Lighting a restricted area

**The Problem:** To illuminate a roadway encircling a restricted area at the Shippingport, Pa. Atomic Energy Generating Plant for both visibility and security.

**The Answer:** Revere Star-Lux Luminaires were installed around the entire perimeter of the restricted area, lighting the roadway and a 45° sloping embankment adjacent to it. Star-Lux Luminaires use up to 10,000 lumen incandescent lamps or 250 to 400-watt mercury lamps to provide any of the five A.S.A.-I.E.S. light distribution patterns.



No. 2311-A/2363
Star-Lux Luminaire

*Write for Revere's complete catalog of outdoor lighting equipment*

Revere ELECTRIC MFG. CO.

**OUTDOOR LIGHTING**

**Revere Electric Mfg. Co. • 7420 Lehigh Ave. • Chicago 48, Ill. • SPring 4-1200**

*Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario*

# "We expect these diffusers cast of Du Pont acrylic monomer to keep their beauty for the life of the fixtures"

The Deering Milliken Building, 1045 Sixth Ave., New York City. Architects: Carson & Lundin, New York City. Fixture manufacturer: The Frink Corp., Brooklyn, N. Y. Installation: Eastern States Electrical Contractors, Inc., New York City.

**Diffusers cast by The Polycast Corp., Stamford, Conn.**

Says Roy Duncan, superintendent of New York's new Deering Milliken Building. "The assignment was to get the 'most exciting ceiling in New York' for our first three floors. So the architects designed the checkerboard layout and specified diffusers that are cast from Du Pont acrylic monomer.

"These panels were selected because they diffuse the light perfectly, maintaining maximum efficiency for years. They disguise the presence of fluorescent tubes and can be used in larger areas than other types.

"Also, they're extremely durable and easily cleaned, which keeps our maintenance problems at a minimum. We expect these diffusers,* cast by The Polycast Corp. of Stamford, Conn., to last the life of the fixtures. It's obvious why we recommend them highly."

It will pay you to find out how Du Pont's customers are using Du Pont acrylic monomer to produce lighting-fixture shields that will give you outstanding service with a minimum of maintenance. For more information, write: E. I. du Pont de Nemours & Co. (Inc.), Dept. IE-9, Room 2507L, Nemours Bldg., Wilmington 98, Delaware.

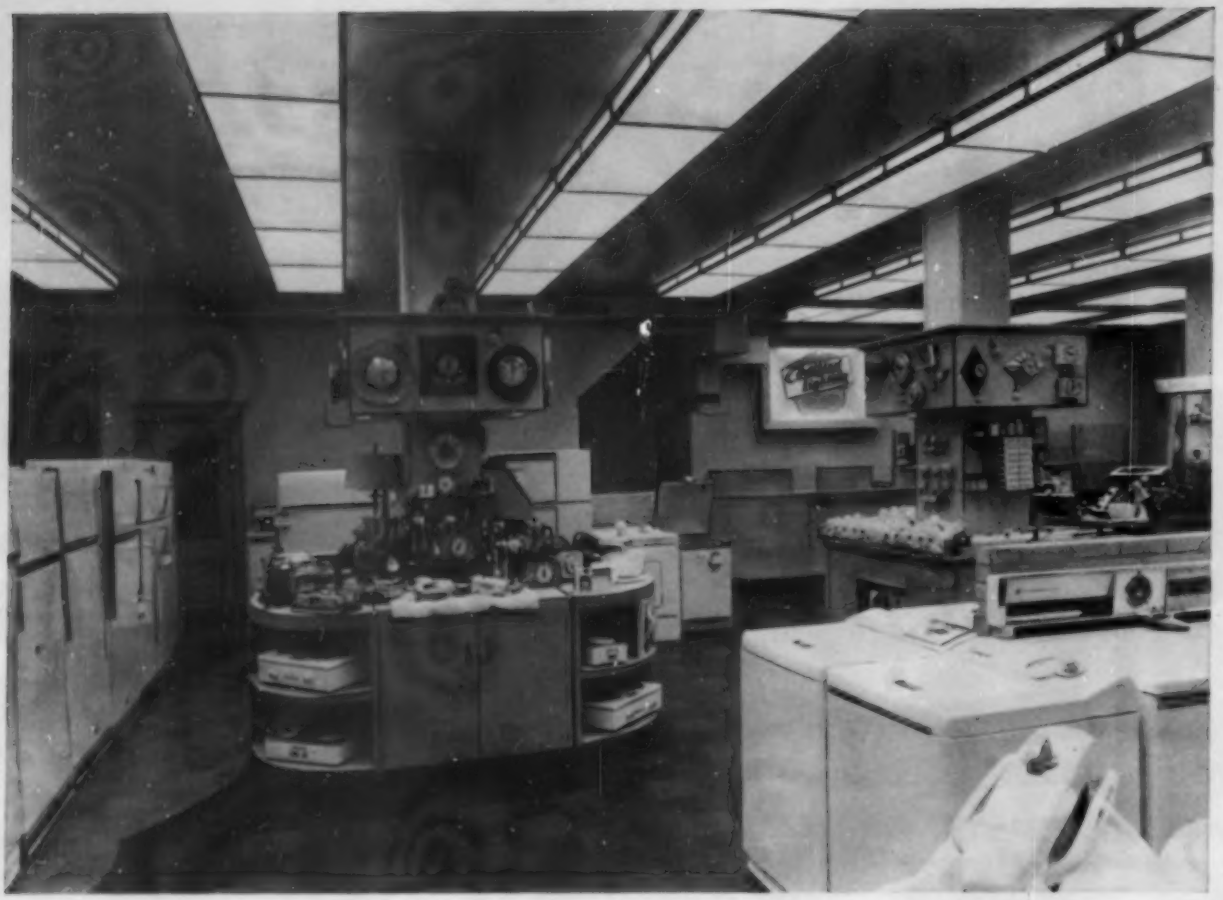
**Flat Polycast acrylic sheet*

**POLYCHEMICALS DEPARTMENT**

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING...*THROUGH CHEMISTRY*



## Haverhill Brings The Sun Indoors (Without Glare) ...with **LITECONTROL** Lighting

Here's an example of "lighting man's lighting" — the high intensity relighting installation at Merrimack-Essex Electric Company, Haverhill, Massachusetts.

Sales-minded as well as illumination-minded, the utility company sought intensity on the appliances to attract customers. Brightness is controlled through Litecontrol fixtures which use the Holophane 6024 acrylic lens.

The fixtures have the eye-appeal to keep pace with the good looking appliances they illuminate. They are rugged, too. Hinged doors on both the four front square fixtures in the background and the two by four fixtures up front afford easy access for service.

This is a superior type of lighting job. But you don't *have* to be a utility to get it! Put it up to Litecontrol. You'll keep costs down, also.

**INSTALLATION:**
Merrimack-Essex Electric Company, Haverhill, Massachusetts

**ENGINEER:**
Clifford White, Merrimack-Essex Electric Company

**ELECTRICAL CONTRACTOR:**
Earl B. Hamel, Haverhill, Massachusetts

**DISTRIBUTOR:**
John D. Osgood, Inc., Haverhill, Mass.

**FIXTURES:**
Litecontrol #7364-RS surface 6 lamp fixtures, and #8584-RS surface 8 lamp fixtures, using F40-T12/CWX/RS Super Deluxe Cool White Rapid Start Lamps

**SPACING:** 6'6" on centers

**CEILING HEIGHT:** 11'-0"

**INTENSITY:**
Average, 225 footcandles, after 260 hours of use.

LITECONTROL
*Fixtures*
KEEP UPKEEP DOWN
LITECONTROL CORPORATION,
36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

(*Continued from page 24A*)

land district and, for the company's new Manchester, N. H. mercury lamp manufacturing facility, the promotion of **John W. Anderson** to the position of plant superintendent.

**Robert V. Corning** has been named to the position of manager—marketing for the General Electric Co. Large Lamp Department in Nela Park, according to an announcement by **Donald D. Scarff,** general manager of the Department. Mr. Corning had been serving in the position temporarily due to the prolonged illness of **Ralph H. Humbert.** Mr. Humbert will remain with the Department as a consultant. In the Distribution Transformer Department of G-E, **James J. Farrell** has been named to succeed **James M. McDonald** as southern regional sales manager. Mr. McDonald is now serving as marketing manager of the Medium Transformer Department.

Corning Glass Works has announced the appointment of **Jack E. Mounteer** as supervisor of lamp product engineering, Electrical Products Division, with offices in Corning, N. Y. In this position, he will be responsible for engineering and development of new and standard glass products for the incandescent, fluorescent, photoflash and mercury lamp industries. Mr. Mounteer had previously been southern California sales engineer for the Electronic Components Department of the company, a position he had held since 1957.

Light & Power Utilities Corp., Olive Branch, Miss., has named **Harold E. Hanna** to the newly-created post of sales administrator and customer relations officer. He will be in charge of liaison between customers and the company headquarters, handle quotations and work directly with the company's network of sales representatives. Mr. Hanna was formerly secretary-treasurer of the Central Electric Supply Co., Pine Bluff, Ark.

Regent Electric Supply Co., Division of Union Electric Supply Co., Ltd., Toronto, Ont. recently appointed **Lloyd K. Hart** as general manager.

Fostoria Corp., Fostoria, Ohio has named **Charles W. McDaniel** to the post of western regional manager with offices in Carmel, Calif. Formerly pacific region agent for Fosoria, he has been affiliated with the company since 1935 when he joined as vice-president in charge of sales. Since 1945, Mr. McDaniel has operated his own company in California, Manufacturers Marketing Service, which he organized to provide western representation for eastern and midwestern manufacturers.

**Michael N. Flynn** has been appointed sales manager of the Benjamin Division of Thomas Industries Inc., Louisville, Ky., according to an announcement by Thomas Fuller, vice-president in charge of general sales for Thomas Industries. In his new position, Mr. Flynn will be responsible for the sale of commercial and industrial lighting fixtures, floodlighting and audible signal lines manufactured by the Benjamin Division at Des Plaines, Ill.

**L. J. Friestedt** is the new national sales manager for Good Manufacturing Co., Chicago, with responsibility for all marketing activities in connection with the company's fluorescent fixture products.

**Marvin Dworkin,** vice-president in charge of the Display (store lighting) Division of Lighting Services, Inc., has announced that **Bill Stern** has joined the company as metropolitan New York sales engineer. Mr. Stern, formerly associated with Bendix Aviation, will be responsible for contact with display directors and department stores.

Kerrigan Iron Works, Nashville, a subsidiary of Rockwell-Standard Corp., has embarked on an expansion program to prepare for the manufacture of seamless, round-tapered aluminum standards, according to a recent announcement by **C. A. Cooper,** vice-president of Rockwell-Standard, in charge of the Miscellaneous Products Group.

Halo Lighting Products, Inc., Chicago, Ill., has announced the appointments of a new salesman and six sales representatives. Named to the Chicago sales position is **John Morgan,** formerly of Presto Appliances; newly appointed representatives are **William Johnson,** Memphis, Tenn.; **Manufacturers Products, Inc.,** Winnipeg, Man.; **Meany, O'Connell and Millerick,** Cambridge, Mass.; **Michael Meshwork,** Montreal, Que.; **Al Rosenstock and Son,** Kansas City, Kans. and **Roland Schillicutt,** Little Rock, Ark.

**Chambers A. Patterson** has resigned from his position as southern and southwestern district manager for Holophane Co., Inc., to operate a manufacturers' representative and illumination consulting office in Houston, Texas.

**Fred Lindenmann** has joined Advance Transformer Co. as a sales representative with headquarters in the company's Chicago office.

The **Richard Donnelly Co.,** Suffield, Conn., has been named Connecticut representative for the Dynaray Emergency Lighting Equipment and Systems line of Electro Powerpacs, Inc., Cambridge, Mass.

### Death

W. A. Maloney, San Diego Section.

## BOOKS AND PAMPHLETS

**Dictionary of Visual Science,** edited by Max Schapero, David Cline and Henry William Hofstetter, published by Chilton Company—Book Division, Philadelphia, Pa., 1960, 785 pages, illustrated. $15.00.

This dictionary of over 13,000 listings is an attempt to compile a volume covering all fields relating to visual science. Emphasis is placed on definitions of terms rather than encyclopedic explanations. Fields covered include: ocular anatomy, ocular embryology, ocular physiology, ocular pathology, neuro-ophthalmology, ocular histology, ocular genetics, comparative anatomy of the eye, ocular prosthetics, physiological optics, phychological optics, ophthalmic optics, geometrical optics, ocular refraction, orthoptics, visual training, dispensing, aniseikonia, perimetry, contact lenses, subnormal vision aids, occupational vision, motorists' vision, remedial reading, statistics, illumination and physical optics.

The editors, who are a Professor of Optometry at the Los Angeles College of Optometry (Dr. Schapero), a practicing optometrist (Dr. Cline) and Professor and Director at the Division of Optometry, Indiana University (Dr. Hofstetter), had the assistance of 61 collaborators and contributors.

**Fluorescent Lamps and Lighting,** edited by W. Elenbaas, published by The Macmillan Co., 60 Fifth Ave., New York 11, N. Y., 1960, 339 pages, illustrated and indexed. $11.00.

This book is a revision of the 1951 *Fluorescent Lighting,* edited by C. Zwikker as a part of the D. E. Philips Technical Library. The same writers who contributed to the 1951 book have brought their contributions up-to-date with new developments and current practice in fluorescent lighting throughout the world.

Subjects treated in this revised text include luminescence, fluorescence, phosporescence, luminescent substances, color of light, color rendition, gaseous discharges, lamp construction, lamp efficien-

(*Continued on page 30A*)

(Continued from page 29A)

cy, stabilization of discharge, lamp types and circuits, ballasts for a-c operation, fluorescent luminaires, lighting progress, quality of lighting, and applications in industry, offices, schools, public buildings, sports, stores, transportation, streets, residences and for agricultural purposes. There are two appendix sections; one on lamps with high luminous output per unit length, and the other on transistor circuits.

**Glass Engineering Handbook,** by E. B. Shand, published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y., Second Edition, 1958, 471 pages, illustrated and indexed. $10.00.

The author, who is a Technical Consultant and was formerly Research Staff Engineer, Corning Glass Works, has intended this handbook to provide information and data for the engineering and technical applications of glass in various fields of use. It is believed that the Handbook will be especially helpful to those industries where technical personnel are primarily not glass technologists.

There are 24 chapters separated into 4 sections—Glass Technology, Glass Manufacture (written partially by Dr. C. H. Greene of Alfred University), Applications (including chapters on electric lamps and illumination) and Fibrous Glass (by J. A. Grant). The chapter on lamps and illumination includes: Vision and Illumination, Glass for Illumination, Indoor Lighting, Lighting of Hazardous Locations, Outdoor Lighting, Incandescent Filament Lamps, and Vapor-Discharge Lamps.

**Tested Tips,** available from General Electric Co., Dept. TIP-1, Nela Park, Cleveland, Ohio.

The first of a bi-monthly series of case histories illustrating the use of better lighting for attracting customers, selling products and improving worker efficiency reports on successful lighting installations in an aluminum manufacturing plant, tool plant, textile, shoe and hosiery manufacturing industries and supermarkets. A table of mounting heights related to room dimensions is included as a guide to the design of 100-footcandle installations with two-lamp, extra-high-output fixtures.

**Noise Control in Buildings,** Publication No. 706, available from Publications Department, Building Research Institute, 2101 Constitution Ave., Washington 25, D. C. 150 pages, $5.00.

This book analyzes the noise control problems arising in all types of buildings due to the increased use of lighter weight construction for exterior walls, interior partitions and floors. Noise problems created by such mechanical equipment as high velocity air conditioning and ventilating systems, high frequency lighting, air duct terminal devices and communication systems are also discussed. Recommendations on how to design for noise control and a complete model specification for the control of noise from mechanical equipment provide a practical guidance for the building designer.

# NEW MEMBERS

At the meeting of the IES Council Executive Committee on July 15, 1960, the following were elected to membership. Names marked * are transfers from Associate Member Grade.

### Arizona Section

*Member:*
*Strupp, P. J., Electric Supply, Inc., Phoenix, Ariz.
*Associate Member:*
Schneider, B. J., Myers-Leiber Sign Co., Phoenix, Ariz.

### Arkansas Chapter

*Associate Member:*
Wheeler, E. E., Graybar Electric Co., Little Rock, Ark.

### Arrowhead Chapter

*Associate Members:*
McBay, J. M., General Electric Supply Co., San Bernardino, Calif.
Schultz, K. F., House of Lights, Riverside, Calif.

### British Columbia Section

*Associate Members:*
Corletto, Ian, McLaren Electric Ltd., Vancouver, B. C.
Hughes, J. A., Cochrane Stephenson (Western) Ltd., Vancouver, B. C.
McKenzie, N. F., 775 E. 14th Ave., Vancouver, B. C.
Miglan, Ralph, Dept. of National Defence, Army, Vancouver, B. C.
Telford, R. F., Electrolier Mfg. Co. Ltd., Vancouver, B. C.
Wood, Barry, McLaren Electric Ltd., Vancouver, B. C.

### Central Illinois Chapter

*Associate Member:*
Ackley, G. E., Caterpillar Tractor Co., Peoria, Ill.

### Chicago Section

*Members:*
*Adrian, W. M., 2948 Simpson St., Evanston, Ill.
Franke, J. E., 228 N. LaSalle St., Chicago, Ill.
*Fuchs, Theodore, N. U. Speech Bldg., Evanston, Ill.

### Cleveland Section

*Associate Member:*
Riddle, M. J., Cleveland Electric Illuminating Co., Cleveland, Ohio.

### Coastal Bend Chapter

*Associate Member:*
Klingaman, G. A., Westinghouse Electric Corp., Corpus Christi, Texas.

### Cornhusker Section

*Associate Member:*
Failla, Victor, Consolidated Engineering Corp., Omaha, Nebr.

### Diablo Section

*Member:*
*Mausshardt, M. R., Electrical Products Corp., Oakland, Calif.
*Associate Member:*
Ham, H. H., Bal Electric Inc., Livermore, Calif.

### Eastern New York Section

*Associate Member:*
Neville, D. J., Niagara Mohawk Power Corp., Hudson, N. Y.

### Eastern Pennsylvania Section

*Associate Member:*
Buchert, R. K., General Electric Supply Co., Allentown, Pa.

### Edmonton Chapter

*Associate Member:*
Hanna, W. H., Cochrane Stephenson (Western) Ltd., Edmonton, Alta.

### Florida Section

*Members:*
*Best, B. P., Healy & Latimer, St. Petersburg, Fla.
Byrnes, Elizabeth S., Tampa Electric Co., Tampa, Fla.
*Hayes, H. G., Florida Power & Light Co., Sarasota, Fla.
*Minton, R. B., Bishop & Johnson, Inc., Tampa, Fla.
*Associate Members:*
Alder, V. J., General Electric Supply Co., Sarasota, Fla.
Corbett, G. L., Corbett Electric, Bradenton, Fla.
Franks, W. A., Franks Electric Center, Longboat Key, Fla.
Hitner, R. M., Graybar Electric Co., Inc., Tampa, Fla.
Mason, J. E., R.E.B. Associates, Inc., Tampa, Fla.
Seitz, P. J., General Electric Supply Co., Sarasota, Fla.
Vandegrift, W. N., Graybar Electric Co., Tampa, Fla.

### Forest City (London) Chapter

*Associate Member:*
Devereaux, R. J., Devereaux & Haggarty, London, Ont.

### Golden Gate Section

*Member:*
*Kunde, B. V., Line Material Industries, S. San Francisco, Calif.
*Associate Members:*
Dittman, F. J., Metropolitan Life Insurance Co., San Francisco, Calif.
Haeder, S. M., U. S. Navy, San Francisco Naval Shipyard, San Francisco, Calif.
Quisenberry, H. F., Bethlehem Steel Corp., San Francisco, Calif.
Rowley, W. C., Graybar Electric Co., Inc., San Francisco, Calif.
Waisanen, E. E., CEPCO, Inc., San Francisco, Calif.

### Hamilton, Ontario Chapter

*Associate Member:*
Hennigar, C. A., Walter, Fedy & Associates Ltd., Kitchener, Ont.

### Heart of America Section

*Member:*
*Dawson, G. V. Jr., H. E. Williams Products Co., Carthage, Mo.

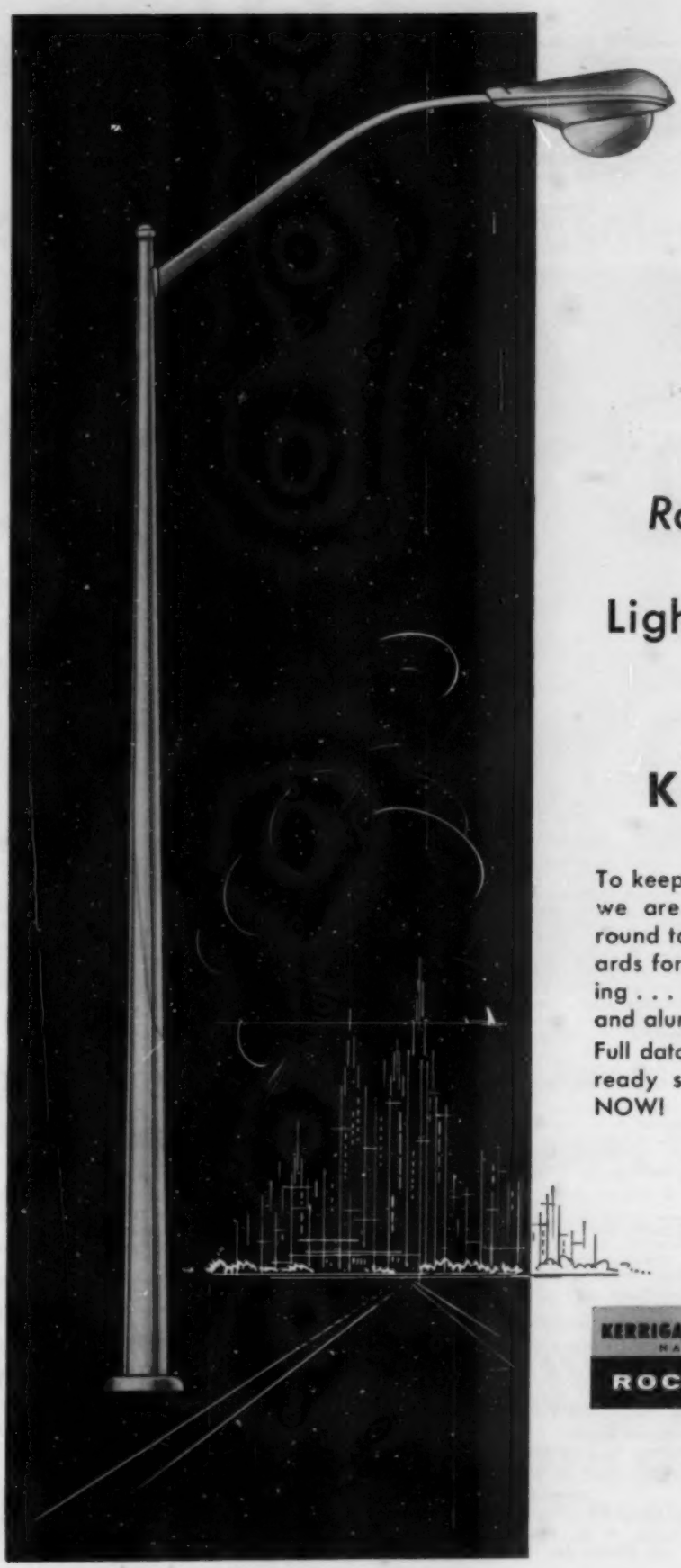
### Housatonic Chapter

*Associate Member:*
Friedman, Clarence, Geo. J. Steinhardt Inc., Bridgeport, Conn.

### Illini Chapter

*Member:*
*Toney, B. F., Decatur Electric Supply Div., Hawkins Electric Co., Decatur, Ill.
*Associate Members:*
Thomas, Mrs. Marie A., Illinois Power Co., Decatur, Ill.
Valle, J. A., General Electric Co., Springfield, Ill.

(Continued on page 32A)



# NOW

## *Seamless Round Tapered Aluminum* Lighting Standards

## *by* KERRIGAN

To keep pace with the growing market, we are now manufacturing seamless round tapered aluminum lighting standards for street, highway and area lighting . . . . . in addition to our line of steel and aluminum octagonal shafts.

Full data catalog for the new line will be ready soon, Reserve your FREE copy NOW!

*Address: Dept. I-8.*

KERRIGAN IRON WORKS COMPANY
NASHVILLE, TENNESSEE
ROCKWELL-STANDARD

**CHECK for $500 for United Engineering Center Building Fund is presented to IES President Joe B. Browder by William H. Keen (right), Chairman of the New York Section. At left is Richard S. Wissoker, Section Treasurer. This donation, from the Section's treasury, is in addition to the $4800 quota established for the 441 New York Section members as part of the national IES bogey of $75,000. Presentation was made at the June meeting of Council in New York City.**

(*Continued from page 30A*)

INDIANA SECTION

*Associate Members:*
Apple, R. P., General Electric Supply Co., Indianapolis, Ind.
Ferguson, J. H., J. Lloyd Allen, Indianapolis, Ind.
Hammer, C. C., General Electric Supply Co., Indianapolis, Ind.
Moore, G. L., General Electric Supply Co., Indianapolis, Ind.
Roach, G. P., General Electric Supply Co., Indianapolis, Ind.
Stees, G. I., William J. Strain, Architect, Bloomington, Ind.
Vandivier, R. E., John C. Virden Co., Indianapolis, Ind.

KENTUCKIANA CHAPTER

*Member:*
*Lawson, W. H., W. H. Lawson Lighting Agency, Louisville, Ky.
*Associate Members:*
Harbolt, K. L., Hatfield Electric Co., Inc., Louisville, Ky.
Isaacs, I. K., E. R. Ronald, Louisville, Ky.
Richey, M. B., Hatfield Electric Co., Inc., Louisville, Ky.
Windhorst, O. H., Reddy Electric Co., Louisville, Ky.

MARITIME CHAPTER

*Associate Member:*
Grant, H. S., N. B. Electric Power Commission, Fredericton, N. B.
Morrison, J. F., Thornes Hardware Ltd., St. John, N. B.

MARYLAND SECTION

*Member:*
*Schlesinger, J. F., Baltimore Gas & Electric Co., Baltimore, Md.

MEXICO CHAPTER

*Member:*
Polis, L. B., Philips S.E.T., Mexico, D. F., Mexico.

MICHIGAN SECTION

*Members:*
*Henson, A. R., Dynamic Industrial Sales Co., Detroit, Mich.
*Kuschwa, R. L., Sylvania Electric Products, Inc., Detroit, Mich.
*Rooney, R. B., The Detroit Edison Co., Mt. Clemens, Mich.

MISSISSIPPI SECTION

*Members:*
Ward, G. H., G. H. Ward & Associates, Meridian, Miss.
*Blackwell, Leo, Southern Electric Supply Co., Inc., Meridian, Miss.

MONTREAL SECTION

*Member:*
Garand, M. G., Bedard-Girard Ltd., Montreal, Que.
*Associate Members:*
Gaboriault, Normand, Southern Canada Power Co. Ltd., Montreal, Que.
Lessard, Henry, Du Bo Electrical Supplies Ltd., Montreal, Que.

NEW ENGLAND SECTION

*Associate Members:*
Buset, Knut, Sylvania Electric Products, Inc., Salem, Mass.
Farnham, J. R., Cape & Vineyard Electric Co., Hyannis, Mass.
Kent, S. L., LAM Inc., Wakefield, Mass.
Meaney, J. J. Jr., Meaney-O'Connell-Millerick, Inc., Cambridge, Mass.
Milward, P. E., Quincy Trade School, Quincy, Mass.
White, C. D., Charles D. White Co., Boston, Mass.

NEW JERSEY SECTION

*Member:*
*Binder, A. A., American Lighting Corp., Hackensack, N. J.
*Associate Members:*
Allison, C. G., Bogart & Hansen, Inc., Montclair, N. J.
Cooper, R. P. Jr., Jersey Central Power & Light Co., Asbury Park, N. J.
Green, Stanley, 26 Mill Road, Nixon, N. J.
Johnson, E. B., Westinghouse Electric Corp., Newark, N. J.
Rembold, J. R., General Electric Co., Newark, N. J.

NEW MEXICO CHAPTER

*Associate Members:*
Cordova, Ruben, Fluorescent Maintenance Service, El Paso, Texas.
Mees, D. G., Electrical & Mechanical Supply Co., Inc., El Paso, Texas
Pollard, H. L., El Paso Natural Gas Co., El Paso, Texas.
Rodgers, R. E., Gamblin Electric Co., Albuquerque, N. M.
Schupbach, Leon, Electrical & Mechanical Supply Co., Inc., El Paso, Texas.
Steed, H. E., Hodges Electric Co., Inc., El Paso, Texas.

NEW YORK SECTION

*Associate Members:*
Horgan, A. F., General Electric Co., New York, N. Y.
Liamets, David, McPhilben Mfg. Co., Inc., Brooklyn, N. Y.

NON-SECTION

*Associate Members:*
Kuniyuki, R. I., Veteran's Electric Co., Ltd., Honolulu, Hawaii
Shak, Clarence, 3620 Waialae Ave., Honolulu, Hawaii.

NORTH TEXAS SECTION

*Associate Member:*
Morgan, R. L., Jack Morgan Co., Inc., Dallas, Texas.

OHIO VALLEY SECTION

*Associate Member:*
Granser, W. E., City of Cincinnati, Cincinnati, Ohio.

OREGON SECTION

*Members:*
*Farley, F. A., Thomas Industries (Benjamin Electric Mfg. Co.), Portland, Ore.
*Sposito, S. J., Lighting Specialties, Portland, Ore.

OTTAWA CHAPTER

*Member:*
*Wilson, Dalton, J. A. Wilson Lighting & Display Ltd., Bells Corners, Ont.

OZARK CHAPTER

*Associate Member:*
Campbell, C. D., Southern Materials Co., Springfield, Mo.

PALMETTO SECTION

*Associate Members:*
Brock, J. R., Champion Paper & Fibre Co., Canton, N. C.
Cook, C. G., General Electric Co., Hendersonville, N. C.
Dengler, L. L., General Electric Co., Hendersonville, N. C.
Young, S. R., General Electric Co., Hendersonville, N. C.

PHILADELPHIA SECTION

*Associate Members:*
Appell, G. C., Owens Corning Fiberglas Corp., Philadelphia, Pa.
Ricciuti, J. B., Food Fair Stores Inc., Philadelphia, Pa.
Silverbook, Harold, Silverbook Electric Service, Philadelphia, Pa.
Tahner, F. A., George M. Ewing Co., Philadelphia, Pa.

PITTSBURGH SECTION

*Associate Members:*
Eisley, J. W. Jr., West Penn Power Co., Uniontown, Pa.
Keppie, R. A., West Penn Power Co., Latrobe, Pa.

ST. LOUIS SECTION

*Member:*
*McCormick, P. W., Union Electric Co., St. Louis, Mo.
*Associate Members:*
Johanson, J. E., Union Electric Co., St. Louis, Mo.
Oertli, F. G., Guarantee Electrical Co., St. Louis, Mo.

ST. MAURICE VALLEY CHAPTER

*Member:*
Girard, F. G., Sylvania Electric (Canada) Ltd., Drummondville, Que.

SAN DIEGO SECTION

*Member:*
*Kenney, D. S., 3814 5th Ave., San Diego, Calif.

SOUTHEAST FLORIDA SECTION

*Associate Members:*
Avedon, Arnold, Avedon Lighting & Electric Products Inc., Miami, Fla.
Knestrick, A. J., Avedon Lighting & Electric Products Inc., Miami, Fla.

SOUTHERN CALIFORNIA SECTION

*Associate Members:*
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(*Continued on page 43A*)

# KOPP *Flying Glassware*

## for specialized requirements of the Jet Age

*Illustration Courtesy of TWA—Trans World Airlines*

TWA Boeing 707 dome lights are designed and produced by Grimes Manufacturing Company. Special blue lenses, illustrated below, are Kopp engineered.

## Kopp Glassware is widely used in Airports, Runways and Aircraft

Blue dome light lenses on jet planes are only one example of many "Flying" glassware products which Kopp designs and makes for specific requirements. Others include instrument panel lighting, navigation lights and warning lights.

Kopp lenses, color filters and other lighting glassware are specially designed as to dimension, color, shape, beam control, light distribution and various physical properties.

Write us about your special design problems. Sending preliminary drawings, before your design specifications are finalized, will frequently save you time and money. Ask for our brochure on Kopp Engineered Glass.

**Kopp Glass, INC.**

**Swissvale, Pennsylvania**

KOPP GLASS

# Jefferson's new DRI-LOK ballast can't drip compound—ever!

Jefferson has definitely solved the messy problem of ballast compound leakage—by replacing conventional compound with an entirely new thermo-setting material. It fills the *entire* case and *permanently* bonds case, core and coil into one solid unit. This dry, solid-fill material is so chemically and physically stable, it cannot combine or react with any other material in the ballast—it cannot soften or liquefy under any operating conditions—for the life of the ballast. The DRI-LOK is the only ballast ever built that offers this positive protection against compound leakage.

**THE NEW DRI-LOK BALLAST IS ENGINEERED TO MEET NEWLY PROPOSED CBM HIGHER LIGHT OUTPUT STANDARDS**

The extreme stability and solidity of the DRI-LOK fill material assures that *every* DRI-LOK ballast will deliver uniform full rated light output, and be uniform in temperature and sound level, whether the installation contains 2 or 200 ballasts!

*Write today for complete details and specifications.*

**Jefferson DRI-LOK**

*New Blue FLUORESCENT BALLASTS*

Jefferson Electric Company • Bellwood, Illinois

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**Successful plastic extrusions for lighting REQUIRE integration of engineering with production techniques. This is an automatic service at K-S-H. In fact, K-S-H has pioneered the way in developing new production techniques and new products through engineering.**

**Insist on this complete K-S-H system to be sure of successful plastic lighting installations.**

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LIGHTING...

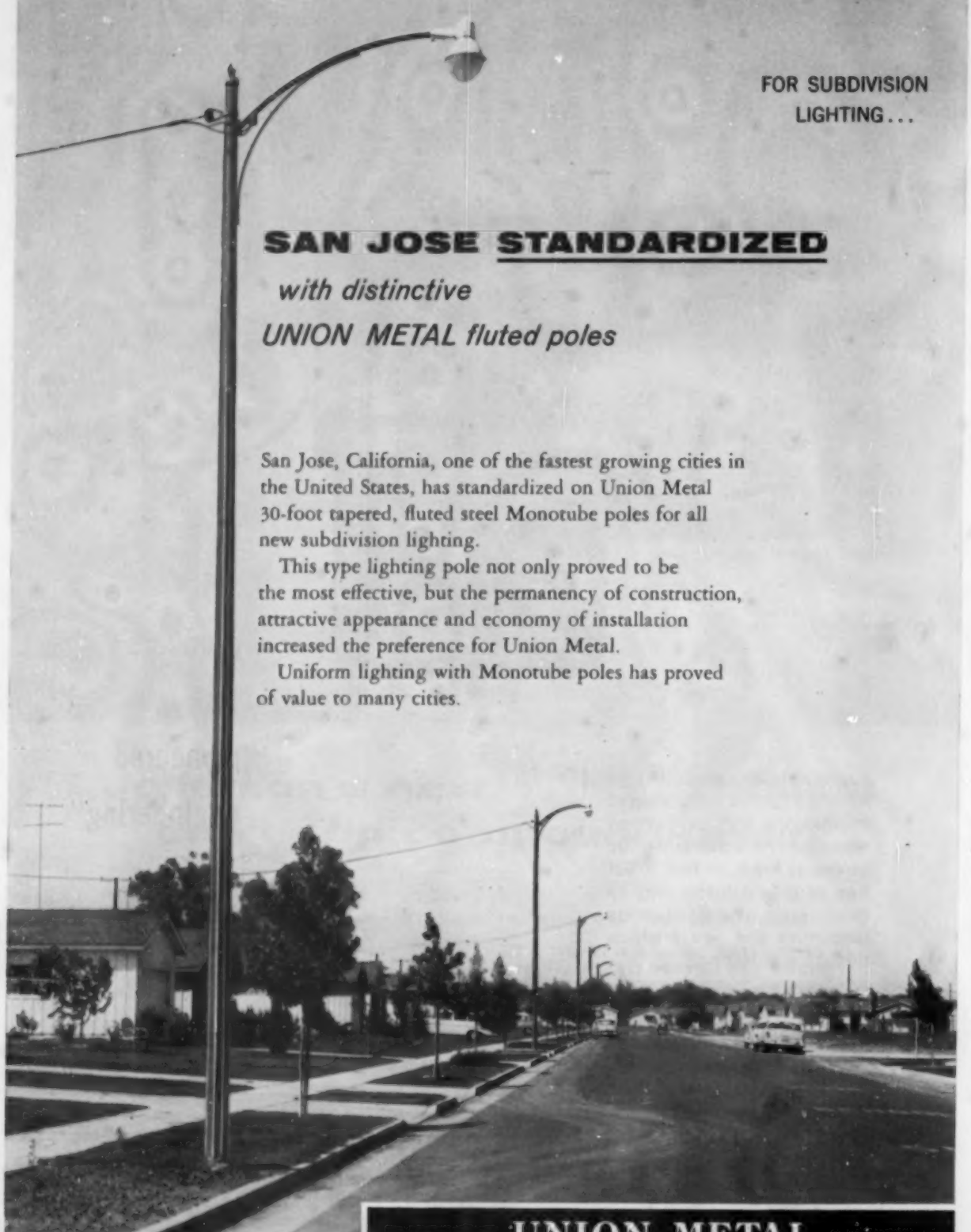
## SAN JOSE STANDARDIZED

*with distinctive*
*UNION METAL fluted poles*

San Jose, California, one of the fastest growing cities in the United States, has standardized on Union Metal 30-foot tapered, fluted steel Monotube poles for all new subdivision lighting.

This type lighting pole not only proved to be the most effective, but the permanency of construction, attractive appearance and economy of installation increased the preference for Union Metal.

Uniform lighting with Monotube poles has proved of value to many cities.



*Residential subdivision lighting... standardized with 30' Monotube poles mounting incandescent luminaires.*

UNION METAL
The Union Metal Manufacturing Company
Canton 5, Ohio Brampton, Ontario, Canada
MONOTUBE LIGHTING POLES

# Anyone can Claim to Meet the RLM Standards for Uniform Quality

# BUT

**unbiased proof of conformance can only be had through repetitive tests by an independent laboratory such as is guaranteed by manufacturers offering RLM-LABELED LIGHTING EQUIPMENT**

**When a buyer takes delivery on incandescent, fluorescent or mercury lighting equipment he has a right to expect that every fixture will meet his specifications in all respects.**

With RLM-Labeled equipment uniform quality is guaranteed by the manufacturer . . . as well as by the RLM testing and certification program. This program is conducted by the world-famous independent testing organization, The Electrical Testing Laboratories of New York and hence represents the most modern testing program in the lighting industry. Under this program it is not enough that certain samples meet RLM Standards. *Every fixture* to which the manufacturer affixes a RLM Label is warranteed by the manufacturer to meet applicable RLM Specifications.

**Here you have one reason why there can be no such thing as a "RLM type" fixture . . . Either *it is RLM* with its testing and certification programs to guarantee uniform quality and high standards . . . *or it is NOT RLM!***

THE FINAL INGREDIENT OF BEING SURE

ETL Sphere Test used to determine overall efficiency of RLM incandescent lighting units.

*These TWIN QQ's to Industrial Lighting Success* are guaranteed with all lighting equipment bearing the RLM Label. Again there are **new and upward Revised Standards for 1960.** Mail coupon today.

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Please send free copy of the new "TWIN QQ" Pamphlet, the 1960 RLM SPECIFICATIONS BOOK and names of 22 leading manufacturers offering RLM-Labeled lighting equipment. (Please write name, company and address in margin below.)

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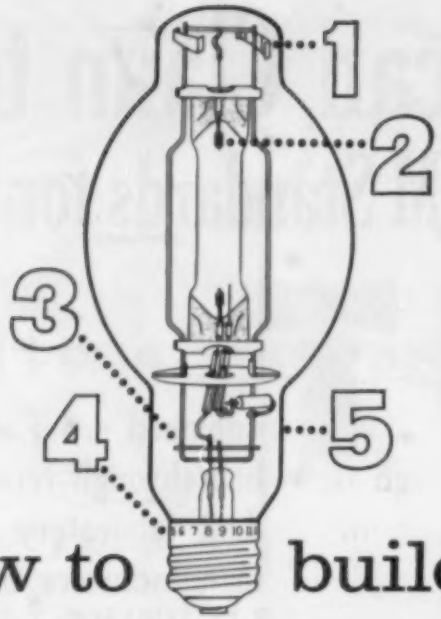
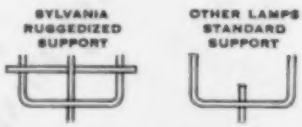



# How to build the world's best mercury lamp

## 5 bright ideas that make Sylvania Mercury Lamps outstanding...and a 6th that guarantees it!

**1 Built-in "Shock Absorbers."** Top-down view of Sylvania Ruggedized Dome Support shows tough double-leaf springs. They absorb shocks, vibrations, maintain correct position of arc tube. Even under roughest wear, Sylvania Mercury Lamps keep burning bright.

**2 Brighter, faster lighting . . . even at 20°F. below!** New Sylvania Trimetallic Electrode construction gives maximum protection, best performance, more light, longer life than any other mercury lamp! Sylvania Lamps start even in dead of winter!




**3 Welded twice-over strongly . . . *that's* support!** Other lamps balance the arc tube on a single welding. If it breaks, good-bye, lamp! Sylvania Ruggedized Base Support has *two* weldings. Result: *more* strength against shocks, vibrations. Longer life with Sylvania!

**4 Bookkeeping done right on the base!** Time-saving, moneysaving idea here! Sylvania Light Recording Base lets you scratch numbers on base representing month, year of installation. With 12,000-hour average rated life, Lamp itself tells how long it's lasted!

**5 "Weather-conditioned" glass shell.** Let it rain, sleet, snow or suddenly turn blistering hot, Sylvania Ruggedized glass shell stands up to all weather, resists thermal shock. No worries any time of the year with Sylvania Mercury Lamp. We repeat: this lamp *lasts!*

**6 Exclusive Sylvania "Light Insurance Policy"**—*This* is your guarantee of best performance, lowest TCL – Total Cost of Lighting (which means cost of lamp plus power plus maintenance). See your Sylvania representative. Or write to us for information.

Sylvania Lighting Products, a Division of Sylvania Electric Products Inc., Dept. 61, 60 Boston St., Salem, Mass. In Canada: Sylvania Electric (Canada) Ltd., P. O. Box 2190, Station "O," Montreal 9.

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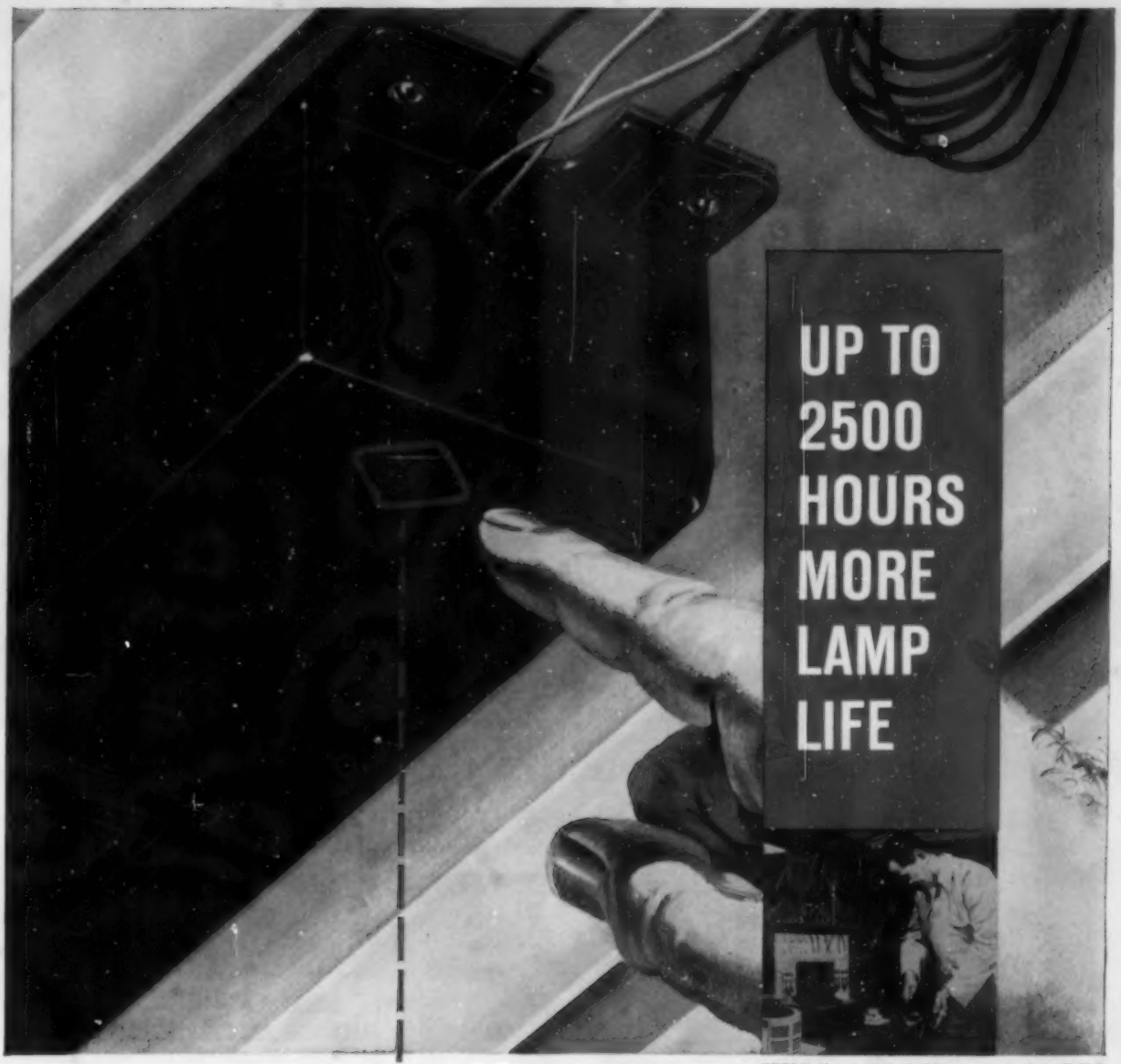


*CBM Ballasts are checked by tests regularly, at E.T.L.*

***And this is one of many advantages which this emblem on a fixture BALLAST assures you!***

**CBM CERTIFIED by ETL**

Because this CBM emblem on a ballast case means checked and certified by Electrical Testing Laboratories to definite CBM specifications . . . "Specs" that assure high light output, positive starting, Power Factor correction . . . dependable, rated performance from fluorescent lamps. And of course, UL listing. They bring other benefits, too . . . savings on installation (fewer circuits needed for fixtures CBM-equipped) and more light (from the same number of fixtures).

It pays to specify fixtures equipped with CBM ballasts. For the latest facts, ask us to send you CBM News.

**Participation in CBM is open to any manufacturer who wishes to qualify.**

**CERTIFIED BALLAST MANUFACTURERS,** 2112 KEITH BUILDING, CLEVELAND 15, OHIO 2-60

# New, cool Sola ballast for two 1500ma lamps gives full light output, features upside-down case

Design features of upside-down ballast assure lowest in-fixture operating temperatures: A Fiber insulator now at label surface. B No thermal barrier at mounting surface to trap normal ballast heat, fixture is improved cooling fin. C Maximum space between capacitor and core structure gives full capacitor life. D Ballast temperatures substantially lower than competitive ballasts (see table at right).

**Comparative Test Results**

| Ballast | Temperatures ° C | | |
|---|---|---|---|
| | Case | Capacitor | Copper |
| Sola 670-130 | 80 | 60 | 87 |
| Ballast X | 81 | 70 | 92 |
| Ballast Y | 86 | 60 | 97 |

*Ballasts tested in industrial fixture suspended one foot beneath ceiling while operating two, 8-foot 1500ma lamps. Ambient room temperature 25° C.*

Newest member of Sola's growing family of upside-down fluorescent ballasts is Catalog No. 670-130. It operates two 96-inch 1500ma lamps down to 0°F, or two 72-inch 1500ma lamps down to –20° F.

The new ballast delivers full light output and is the coolest-operating, 18-inch, single-case unit of its type that we've tested. Results of in-fixture comparative tests of the Sola ballast and two of its competitors are shown above. Further tests prove that Catalog No. 670-130 easily meets latest CBM specifications for two-lamp 1500ma ballasts.

A good share of the new unit's improved performance and life-extending operating temperatures is a result of Sola's ingenious solution to the problem of heat dissipation which is diagrammed above.

The next time you need a ballast that will help quality fluorescent fixtures deliver all the light that's engineered into 1500ma lamps, that will give coolest possible in-fixture performance, that will live up to its own rated life, that's the time to specify Sola Catalog No. 670-130. Engineers and fixture manufacturers are invited to send for sample ballasts.

***Write for Bulletin 3H-FL***

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A DIVISION OF BASIC PRODUCTS CORPORATION

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Eye-easy
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The series of 24 sheets, printed on heavy paper and punched for binder, will be shipped to you in three lots of 8 sheets each, every four months during subscription year, an ideal interval for distribution to customers and contacts. First shipment in June.

Subscribe now to Series XXV, I.E.S. Lighting Data Sheets for your staff, customers, architects and engineers, distributors and contractors; many others. Price $1.25 for series; $1 in lots of ten or more subscriptions.

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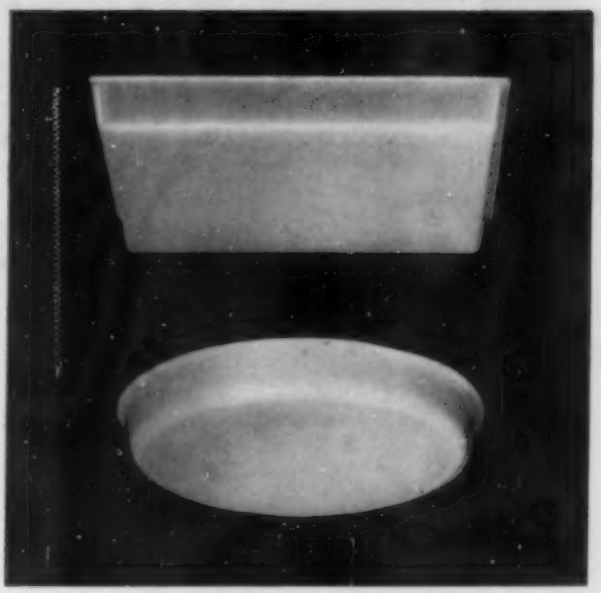
KEELITE
GLASSWARE FOR LIGHTING

# heat-resisting ceiling diffusers



## wide range of sizes available from stock

These diffusers are made of homogeneous heat-resisting opal glass. They are available in several sizes from 6 inches to 12 inches in both square and round styles.

Our modern, highly-mechanized production methods enable us to furnish *heat-resisting* glassware for lighting at the same cost as you are now paying for ordinary glass. We invite you to check this point at your earliest opportunity.

Thatcher Glass

*Write for complete specifications and prices*

THATCHER GLASS MANUFACTURING CO., INC. JEANNETTE, PA.

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metco Lighting HAS IT!

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A new economy version of our famous AURORA troffers that offer fine construction and tremendous value. Only 3½" deep! Priced lower than you'd think possible!

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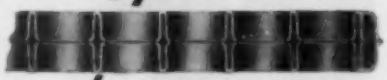
## INDEX TO ADVERTISERS
August 1960


| | |
|---|---|
| Advance Transformer Co. | 1A |
| American Louver Co. | Inside Back Cover |
| Appleton Electric Co. | 18A-19A |
| Certified Ballast Manufacturers | 39A |
| Cirvac Plastics | 42A |
| Corning Glass Works | 6A |
| Day-Brite Lighting Inc. | 4A-5A |
| E. I. du Pont de Nemours & Co. (Inc.) | 26A-27A |
| Edwin F. Guth Co. | Back Cover |
| Jefferson Electric Co. | 34A |
| Kerrigan Iron Works, Inc. | 31A |
| Keystone Electric Mfg. Co. | 2A |
| Kopp Glass Inc. | 33A |
| KSH Plastics Inc. | 35A |
| Lighting Products Inc. | 20A |
| Lightolier | 44A |
| Litecontrol Corp. | 28A |
| R. A. Manning Co. | 41A |
| Meierjohan-Wengler | 43A |
| Metalcraft Products Co. Inc. | 42A |
| Monsanto Chemical Co. | 17A |
| Revere Electric Mfg. Co. | 25A |
| RLM Standards Institute | 37A |
| Sola Electric Co. | 40A |
| Sunbeam Lighting Co. | 23A |
| Sylvania Electric Products Inc. | 38A |
| Thatcher Glass Mfg. Co. | 41-A |
| Thompson Electric Co. | 43A |
| Union Metal Mfg. Co. | 36A |
| Wakefield Co. | Inside Front Cover |



# CIRCLGRID LOUVERS

Listed UL 20
(Non Combustible)



Enlarged cross section view

Nominal Sizes—2' x 2' x ½"
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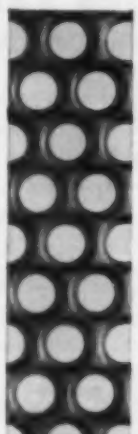
Translucencies—300-150-75 FC

*With* OUTSTANDING BRIGHTNESS CONTROL

Circlgrids are thermo-formed from 2 sheets of vinyl and fused electronically to a center vinyl membrane for structural strength and rigidity—yet weigh only 3½ oz./sq. ft. Many leading lighting equipment manufacturers are licensed to sell and distribute Circlgrid.



CIRCLGRID ADVANTAGES

- Listed UL 20 (non-combustible)
- Circular openings assure non-glare illumination and promote free air circulation
- Safely installed under sprinklers
- Weight-3½ oz./sq.ft.
- Cut-off 45°-45°
- Can be contoured to fit irregular areas
- Outstanding brightness control

*Write for sample and technical data.*

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(*Continued from page* 32A)

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***Relamping alone cannot maintain peak lighting efficiency!*** Dirty luminaires waste money as well as foot-candles. But vitally necessary periodic washing . . . under most serving methods . . . involves almost prohibitive cost and hazard to personnel.

***Thompson Hangers reduce servicing costs and eliminate all climbing and electrical dangers automatically.*** They permit one unskilled man . . . without assistance or special auxiliary equipment or personal hazard . . . to service a fixture within a few minutes at floor level. And that's why Thompson Hangers are the fastest, safest and most economical method of maintaining peak lighting efficiency at minimum cost.

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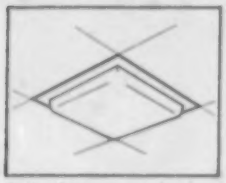
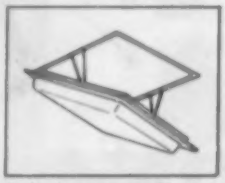
# *CALCULITES by LIGHTOLIER*

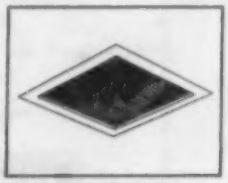
This new coordinated, quality group fits nearly any downlighting need and does it 1. attractively, 2. efficiently and 3. effectively. Example: the Calculite below articulates the ceiling-fixture joint with an opaque metal skirt. The albalite diffuser sends a flood of illumination to the working surfaces. Available: seventeen other models, 96 sizes and finishes, round and square shapes, for wide, medium and narrow light distribution.



*Calculites complement your precision detailing. Example: the new formed glass unit above exactly replaces a 12" x 12" ceiling tile, fits perfectly flush with the finished ceiling surfaces.*



*Calculites are efficient lighting instruments. Example: Torsiontite spring above permits safe, easy relamping, pulls down from any side. Foam gaskets provide tight seal.*



*For a simple low-brightness unit exactly flush to the ceiling plane choose the Prismatex Calculite above. In baked white enamel or weatherproof anodized satin aluminum.*

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**NEVADA**
*Reno:* Electric Elec. Mach. Co.

**NEW HAMPSHIRE**
*Portsmouth:* Mass. Gas & Elec. Light Co.

**NEW JERSEY**
*Atlantic City:* Franklin Elec. Sup. Co.
*Cherry Hill:* Delaware Township
Flynn's Camden Elec. Fix. Co.

**NEW MEXICO**
*Albuquerque:* The Lighting and Main. Co.

**NEW YORK**
*Binghamton:* Frolic Elec. Sup. Co.
*Buffalo:* Buffalo Inland Light Co. Inc.

**NEW YORK** (cont.)
*Niagara Falls:* Hyson Supplies Inc.
*Poughkeepsie:* Electric Sup. Co.
*Rochester:* Stone Electric Sup. Co.
*Syracuse:* Superior Elec. Corp.

**NORTH CAROLINA**
*Charlotte:* Independent Elec. Sup. Co.
*Durham:* Reiland Co.
*Greensboro:* Elec. Sup. & Equip. Co.
*Kinston:* Kinston Elec.
Winston Salem: Reiland Co.

**NORTH DAKOTA**
*Fargo:* Northwest Elec. Sup. Inc.

**OHIO**
*Akron:* The Sachs Elec. Sup. Co.
*Canton:* Electric Sales Co.
*Cincinnati:* G. & R. Elec. Co.
F. D. Lawrence Electric Co.
Richards Elec. Sup. Co.
*Cleveland:* The H. Leff Electric Co.
Midland Elec. Co.
*Columbus:* Elgin Elec. Co.
The Lieb Elec. Co.
*Dayton:* Stollman Elec. Co.
*Springfield:* The W. W. Elec. Co.
*Toledo:* Gross Elec. Fix. Co.
*Youngstown:* Warf Industries

**OKLAHOMA**
*Oklahoma City:* Elec. Sup. of Oklahoma

**OREGON**
*Portland:* Baker-Barker Co.

**PENNSYLVANIA**
*Allentown:* Coleman Elec. Co.
*Erie:* Blass Elec. Co.
*Harrisburg:* Fluorescent Sup. Co.
*Hazleton:* Power Elec. Co. Inc.
*New Castle:* Midwestern Elec. Co.
*Philadelphia:* Ace Lighting Fix. Co.
Gold Seal Elec. Sup. Co.
Sylvan Elec. Fix. Co.
*Pittsburgh:* Allied Elec. Sup. Co.

Brown & Green
Wolfe Elec. Sup. Co.
*Reading:* Colonial Elec. Co.
*Scranton:* Lewis & Reif, Inc.
*Uniontown:* Pioneer Electric Dist.
*Wilkes Barre:* Anthracite Elec.

**RHODE ISLAND**
*Pawtucket:* Major Elec. Sup. Co.
*Providence:* Leavitt Colson Co.

**SOUTH CAROLINA**
*Columbia:* Capitol Elec. Sup.
Reiland Co.
*Greenville:* Sullivan Hdwe. Co.

**SOUTH DAKOTA**
*Watertown:* J. H. Larson Elec. Co.

**TENNESSEE**
*Nashville:* Nashville Elec. Sup. Co.

**TEXAS**
*Dallas:* Rogers Elec. Sup. Co.
*Ft. Worth:* Anderson Fixture Co.
Cummins Supply Co.
*Houston:* Gross Electric Supply
Martin Associates
Southern Electric Supply Co
*San Antonio:* Southern Equip. Co.
Strauss Frank Co.

**UTAH**
*Salt Lake City:* Artistic Lighting

**VIRGINIA**
*Arlington:* Hamilton Elec. Sup. Co. Inc.
Reiland Co.
*Fredericksburg:* Old State Elec. Sup. Co., Inc.
*Norfolk:* Reiland Co.
*Roanoke:* Reiland Co.

**WEST VIRGINIA**
*Huntington:* West Virginia Elec. Co.
*Wheeling:* The Trent Co.

**WISCONSIN**
*Appleton:* Nine Northern Co.
*Eau Claire:* W. H. Hobbs Sup. Co.
*La Crosse:* W. A. Roosevelt Co.
*Milwaukee:* Lappin Elec. Co.
Standard Elec. Sup.

**WASHINGTON**
*Seattle:* Seattle Lighting Fix. Co.

**ALASKA**
*Anchorage:* Northern Supply Co.

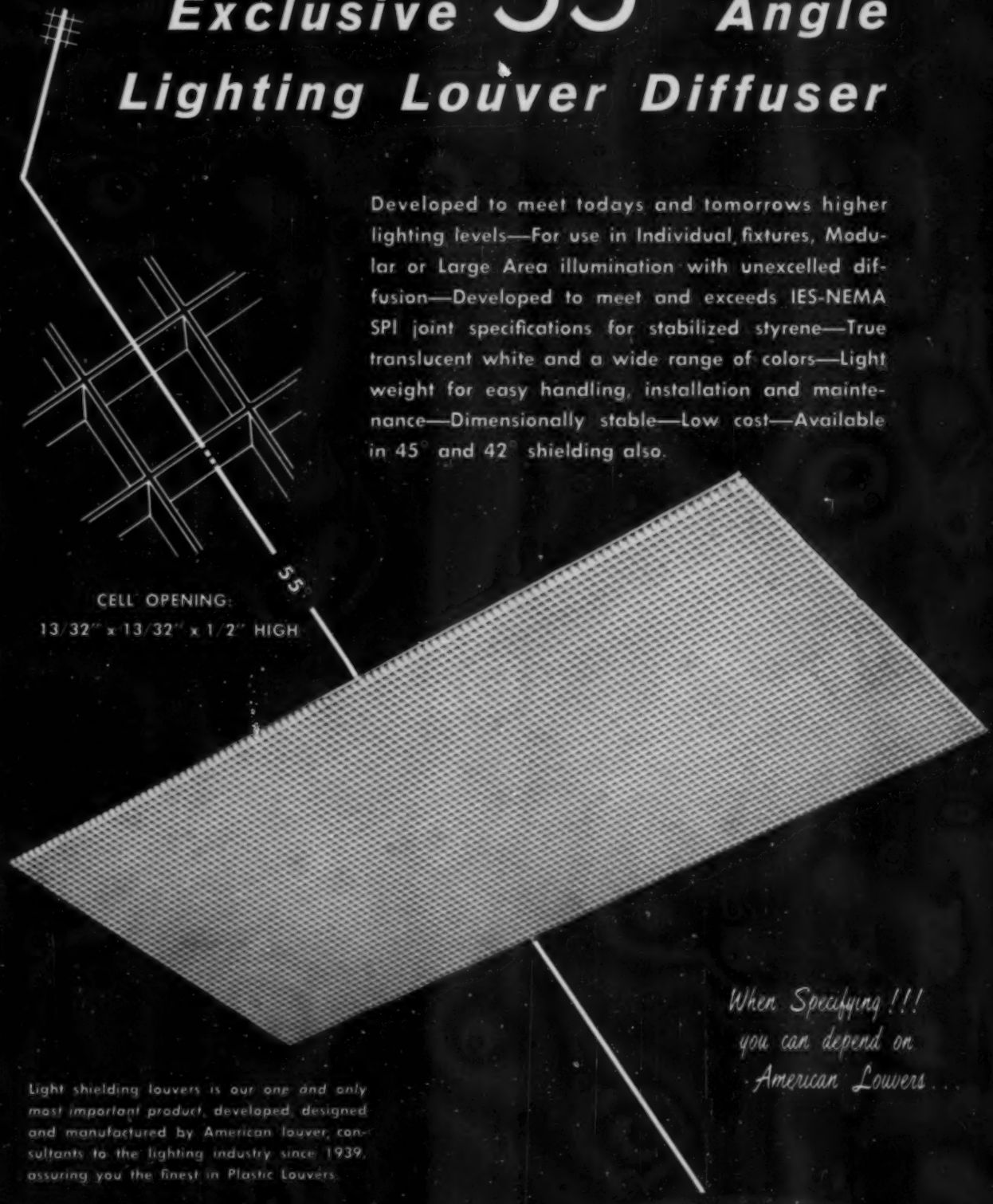
**CANADA**
*Montreal:* L. D. S. Products, Inc.
The Gray Elec. Co.
Union Electric Sup. Ltd.
*Quebec City:* La Cie Maritimme Electric Co.
*Toronto:* Rowen Elec. Dist.
Toronto Ltg. Studios

**HAWAII**
*Honolulu:* Hawaiian Light & Sup. Co.

# NEW!

## Exclusive 55° Angle Lighting Louver Diffuser

Developed to meet todays and tomorrows higher lighting levels—For use in Individual fixtures, Modular or Large Area illumination with unexcelled diffusion—Developed to meet and exceeds IES-NEMA SPI joint specifications for stabilized styrene—True translucent white and a wide range of colors—Light weight for easy handling, installation and maintenance—Dimensionally stable—Low cost—Available in 45° and 42° shielding also.




CELL OPENING:
13/32" x 13/32" x 1/2" HIGH

*When Specifying !!!*
*you can depend on*
*American Louvers*

Light shielding louvers is our one and only most important product, developed, designed and manufactured by American louver, consultants to the lighting industry since 1939, assuring you the finest in Plastic Louvers.

*For pertinent facts on American louvers, write for bulletin 33am and new 3 color catalog—Just off the press.*

**american louver company**

5308 N. ELSTON AVENUE • CHICAGO 30, ILLINOIS

# GUTH GATEWAY

A winning combination of rugged strength, beauty and efficiency in a concave plastic fixture! The Gateway introduces a new concept of design and construction. Plastic is basic . . . but no wrap-a-round. Concave bottoms hinge separately . . . choose GrateLite Louver Diffuser* or Prismoid GrateLite Louver-Lens**.

*100 FC AT 4 WATTS PER SQUARE FOOT!*

**the most efficient, most rugged, concave-plastic drop luminaire available**

Examples — Estimated Ft. Candles — 80/50/30 R. F. — 9′ 0″ to 9′ 6″ Mtg. Ht. — 10′ 6″ to 11′ Ceil. — Row Mtgs.

| with Concave PRISMOID | | | | | with Concave GRATELITES | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rows of lamps | Room Index | | | | Rows of lamps | Room Index | | | |
| | D | C | B | A | | D | C | B | A |
| 2-lite | 52 FC | 59 FC | 67 FC | 71 FC | 2-lite | 48 FC | 54 FC | 62 FC | 66 FC |
| 3-lite | 78 FC | 89 FC | 101 FC | 107 FC | 3-lite | 72 FC | 81 FC | 95 FC | 99 FC |
| 4-lite | 99 FC | 113 FC | 129 FC | 136 FC | 4-lite | 91 FC | 105 FC | 118 FC | 125 FC |

Notes: Room index D is for 30′ x 36′ room using 3-28′ rows
Room index C is for 40′ x 48′ room using 4-40′ rows
Room index B is for 50′ x 56′ room using 5-48′ rows
Room index A is for 60′ x 60′ room using 6-52′ rows

Guth LIGHTING since 1902

**THE EDWIN F. GUTH CO.**
2615 Washington Blvd., Box 7079, St. Louis 77, Mo.

* ® U. S. Pat. No. 2,745,001 Can. Pat. 1957, No. 538,245 ** ® U. S. Pat. No. 2,904,673